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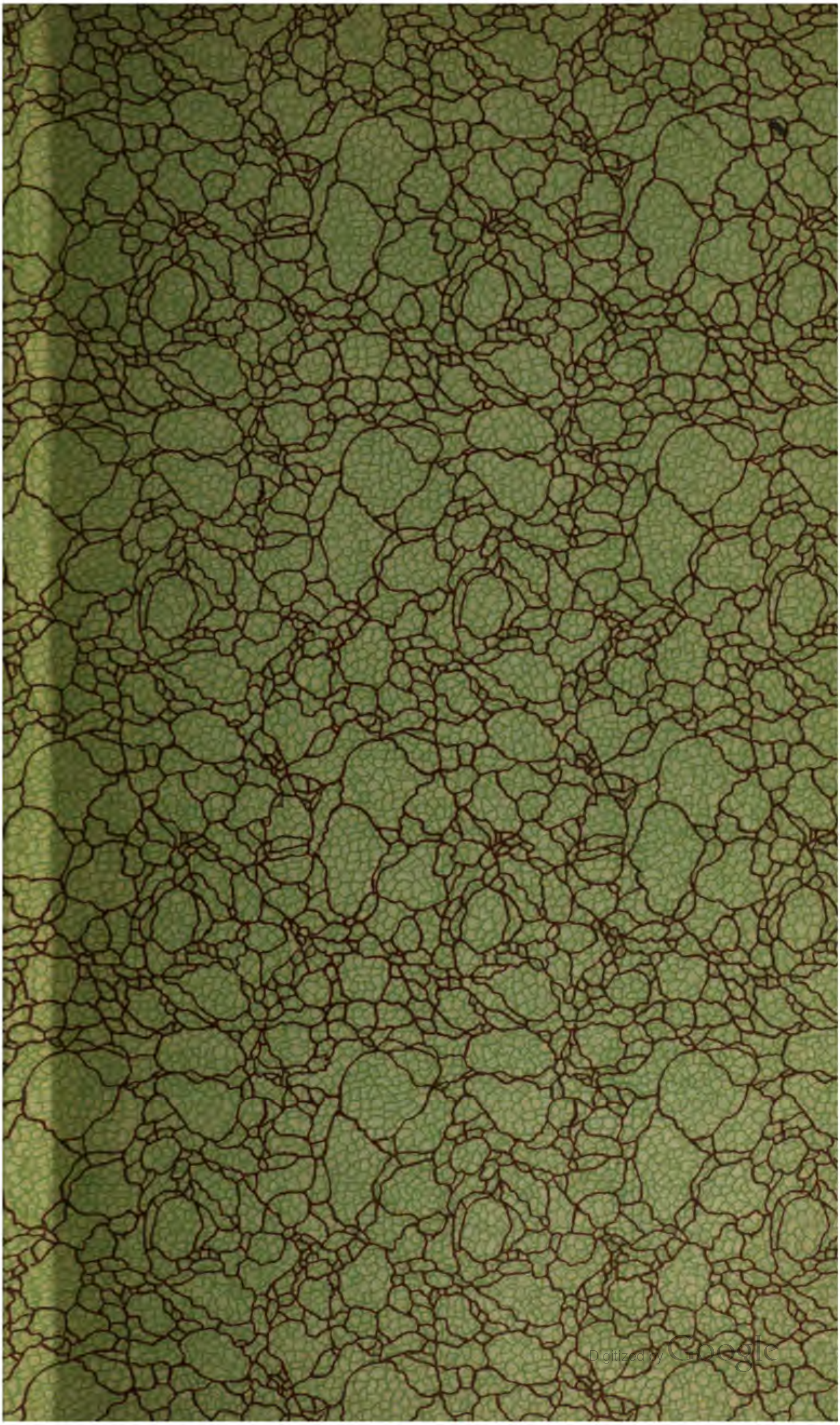

Wm Miller Jr

President

PROCEEDINGS

OF THE

Natural Gas Association of America

ELEVENTH ANNUAL MEETING

HELD AT

Exposition Building, Pittsburgh, Pa.

May 16th, 17th and 18th, 1916

Published by the Association
Edited by the Secretary.

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ELEVENTH ANNUAL MEETING

OF THE

Natural Gas Association of America

HELD

MAY 16th, 17th and 18th, 1916

PROCEEDINGS

FIRST DAY — MORNING SESSION

Tuesday, May 16th, 1916.

The Eleventh Annual Meeting of the Natural Gas Association of America convened at the Exposition Building, Pittsburgh, Pa., at 10 o'clock, A. M., May 16th, 1916, with William Y. Cartwright, of Cincinnati, Ohio, as President, and Thomas C. Jones, of Delaware, Ohio, as Secretary.

The following members reported their attendance:

Abbe, Walter, Jr.
Abbott, C. G.
Abbott, D. E.
Adams, J. A.
Adams, W. H.
Adams, Wm. M.
Altizer, R. G.
Amey, L. C.
Anderson, Hugh
Anderson, J. F.
Anderson, J. W.
Angle, J. E.
Ardis, J. B.
Ardizzone, Joseph
Armstrong, A. A.
Arnold, W. H.
Arras, W. H.
Ashley, Wm. A.
Atkins, I. H.
Bagley, W. H.

Baker, A. G.
Baker, Chas. E.
Baker, W. N.
Ballard, A. M.
Ballew, J. W.
Barger, L. F.
Barnes, Geo. W.
Barnes, R. B.
Barrows, Geo. S.
Barry, James
Bartlett, E. O.
Bartlett, John C.
Bartlett, R. H.
Bartley, H. J.
Bartley, W. A.
Batchelor, G. F.
Bauer, C. J.
Baxter, John
Beach, Ralph A.
Beans, H. P.
Beardsley, R. D.
Beatty, Elmer
Beckett, D. J.
Bedford, A. C.
Bell, C. D.
Benner, Geo. K.
Bernard, H. B.
Biddison, P. McDonald
Bigelow, L. S.
Bigler, G. K.
Billingsley, J. E.
Black, Jas. B.
Black, T. M.
Blum, William
Boice, Wm.
Boocks, G. W.
Boorman, Clarence B.
Bossert, J.
Booth, Arthur
Boothe, Geo. P.
Boothe, R. E.
Borman, Clarence
Bothel, J. O.
Boyd, A. E.
Boyle, P. C.
Braden, Eugene
Braden, Glenn T.
Braden, H. W.
Bradford, F. J.
Bradley, Harry
Bradley, J. B.
Brawley, Hugh P.
Brazier, John B.
Brenner, H. H.
Brewster, Henry
Bridges, J. M.
Brink, George R.
Brink, R. W.
Bristol, B. B.
Broder, W. J.
Brown, Cameron
Brown, D. J.
Brown, Wm. Laird
Brown, W. R.
Bruce, W. W.
Buchanan, James I.
Bulger, J. F.
Burford, Ira S.
Burkhalter, R. J.
Burnett, A. R.
Burns, E. G.
Burns, H. C.
Burns, T. P.
Burnside, S. E. W.
Burr, R. B.
Burrell, George A.

Burson, F. G.
Burson, H. W.
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Campbell, M. L.
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Carpenter, Geo. R.
Carter, Clarence E.
Carter, David J.
Carter, O. M.
Cartwright, T. R.
Cartwright, W. Y.
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Cassel, H. Burd
Casto, A. T.
Cavenau, Chas.
Chapman, W. B.
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Craft, Charles
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Cross, Raymond
Crossett, Jno.
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Cummings, Con.
Cummings, Henry
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Cunningham, R. H.
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Cushing, R. W.
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Dally, C. A., Jr.
Daly, M. B.
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Davies, Stuart W.
Davies, William B.
Davis, Merrill N.
Davis, Silas

Davis, A. P.
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Dixon, P. E.
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Dougherty, F. D.
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Dreibelbis, H. H.
Droppleman, W. J.
Duffield, C. S.
Dunham, Carl C.
Dusenberry, D. F.
Dye, Sam'l R.
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Edwards, William C.
Egan, E. J.
Engle, T. W.
Espach, Frank
Evans, C. D.
Evans, J. J.
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Finney, Frank F.
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Garner, J. B.
Garrity, Michael J.
Gassdorf, G. J.
Gassett, A. L.
Gates, C. B.
Giest, J. F.
Giegel, F. G.
Gifford, B. J.
Gill, John E.

Gilbert, A. J.
Gindele, A. H.
Glass, John
Glass, Roy
Gleason, C. W.
Goff, G. S.
Goldsborough, James R.
Gordon, G. R.
Grace, Clarence H.
Graham, L. L.
Gray, A. R.
Gray, J. F.
Greis, H. N.
Griswold, Robert G.
Griswold, W. T.
Groble, J. C.
Guffey, J. F.
Hagan, O. C.
Hagan, W. G.
Hadley, W. R.
Hall, C. F.
Hall, Herman H.
Hall, J. J.
Hanchett, E. C.
Hanks, J. G.
Hannan, R. W.
Hare, A. S.
Harris, Geo. S.
Harris, W. H.
Hartzell, A. C.
Harwood, J. Arch
Hastings, John
Hastings, William
Hawkins, Benj. L.
Hay, R. H.
Haymond, E. L.
Hazlett, Ira L.
Hazlett, P. S.
Hazeltine, Roy A.
Healy, J. H.
Heazlett, Frank
Heazlett, William
Heeter, C. M.
Heggem, Alf. C.
Hegerty, P. F.
Helm, C. L.
Henderson, C. L.
Henderson, Jas.
Henderson, John I.
Hennessy, Geo. F.
Henning, M. H.
Herr, J. P.
Heydrick, James C.
Higgins, Wm. C.
Hildebrand, H. D.
Hildebrand, J. S.
Hill, C. E.
Hill, D. M.
Hilty, John
Hinerman, G. L.
Hogg, H. B.
Holmes, A. G.
Holbrook, D. O.
Holbrook, L.
Holbrook, W. G.
Holtz, Wm. H.
Hoover, H. J.
Horner, Boyd E.
Horner, Lynn S.
Horsley, Geo. H.
Horton, F. J.
Hottel, A. G.
Hovis, Park
Hovis, W. H.
Howard, R. B.
Howard, G. E.

Huff, Chas. F.
Hugh, Wm. K.
Hull, H. D.
Hulsey, Tom
Hunt, N. T.
Hunter, J. W.
Hutchinson, E. H.
Hutchinson, F. R.
Hutchinson, H. D.
Hutchinson, J. E.
Hutchinson, H. P.
Hurlburt, A.
Ikard, L. D.
Inghram, D. W.
Irwin, J. W.
Ivory, E. D.
Jackson, G. H.
Jay, C. H.
Jay, D. C.
Jenkins, Howard
Jewett, Wm. S.
Jimerson, D. E. O.
Johnson, Paul R.
Johnson, Roswell H.
Johnson, Russell A.
Jolliffe, R. Dale
Jones, C. A.
Jones, C. R.
Jones, Geo. H.
Jones, Hoyle
Jones, T. C.
Jones, T. J.
Jordan, E. W.
Kay, Jos. M.
Keenan, J. E.
Kenney, A. E.
Kerr, P. M.
Kerr, T. H.
Ketler, W. G.
Kidd, J. W.
Kightlinger, A. D.
Kilpatrick, R. B.
Kincheloe, J. G.
Kimmell, C. F.
Kimmel, G. F.
King, E. J.
King, James
King, W. S.
Kingsley, T. C.
Kinley, George A.
Kline, V. P., Jr.
Klise, John J.
Klug, N. J.
Klingensmith, J. M.
Knapp, Frank H.
Knapp, I. N.
Knepshield, Charles
Knowles, W. R.
Krauss, Charles
Krick, K. C.
Lacker, Frank
Ladd, Geo. T.
Lakamp, J. Henry
Lambing, Jno. A.
Landis, H. K.
Larkin, W. H.
Lavell, Lon.
Law, C. C.
Lawrence, Chas.
Layton, M. B.
Leard, R. C.
Leathers, John H.
Lee, Thomas M.
LeFevre, H. E.
Lehman, I. L.
Leidecker, F. H.

Leight, Antony
Leight, Henry G.
Leist, S. C.
Leland, Edward D.
Leonard, A. W.
Leonard, John
Leuell, Lon
LeVier, C. P.
Lewis, A. H.
Light, Harry C.
Lindsay, W. R.
Lipper, E. L.
Lockhart, Robert
Lockwood, W. H.
Loebell, Henry O.
Logue, James J.
Lohr, G. C.
Long, W. A.
Longenecker, W. C.
Lord, R. S.
Lupher, P. W.
Luther, G. W.
Lynn, J. T.
Lyon, J. F.
Lyttle, W. E.
Lytle, V. H.
Magrew, B. A.
Malloney, L. E.
Mallory, L. E.
Marple, M. R.
Martin, F. W.
Martin J. O.
Mascho, C. W.
Mason, J. F.
Mathieu, Louis
Maston, J. R.
Mayne, H. B.
Maxon, J. H.
May, A. G.
McBride, R. S.
McCabe, John G.
McCall, E. P.
McClellan, Arthur
McCalmont, C. P.
McClellan, Joseph
McClelland, J. Y.
McClelland, W. O.
McCloskey, Jas. P.
McCloy, S. D.
McCloy, N. L.
McConnell, H. H.
McCormick, E. P.
McCullough, G. W.
McCune, D. B.
McCutcheon, Sam
McDevitt, J. E.
McDonald, Donald
McDonald, W. H.
McDowell, J. C.
McGee, W. F.
McGilvary, H. J.
McIntyre, M.
McKee, G. R.
McKnight, H. M.
McMahon, J. W.
McMahon, John B.
McMasters, W. C.
McMillan, John,
McMunn, James S.
McNally, J. I.
McNary, L. J.
McNarry, J. F.
McPeake, A. G.
Mead, Carl D.
Meals, S. W.
Mechesney, C. A.

Mellon, Porter D.
Meredith, G. B.
Merkt, Joseph
Metcalf, H. E.
Merrill, Edwin C.
Meyer, Frank J.
Michel, F. M.
Mickley, M. A.
Miller, Ed. A.
Miller, F. A.
Miller, L. L.
Miller, R. R.
Miller, H. G.
Milne, W. E.
Miner, F. W.
Montgomery, John H.
Moore, Edgar M.
Moore, Harry
Moore, Lee C.
Moran, P. A.
Morgan, R. D.
Morgan, W. J.
Morse, Nathan L.
Mowrey, John
Mueller, Fred
Mulkin, P. L.
Munce, J. P.
Munro, W. L.
Murphy, F. C.
Murphy, S. F.
Murray, F. C.
Murray, John J.
Murtaugh, Jas.
Musser, William
Myers, E. E.
Meyer, Frank J.
Nagle, T. J.
Nash, John J.
Nash, Raymond J.
Neely, Ira L.
Neely, L. G.
Nestor, J. F.
Newhouse, B. Frank
Newman, A. J.
Newton, N. A.
Nicholson, French
Nicoll, Thomas
Nole, E. P.
Norris, Henry B.
Northcott, G. A.
Northrup, Chas. S.
Norton, Chas. L.
Nutt, E. B.
Oakes, W. L.
Oberfell, G. G.
O'Brien, Thomas F.
O'Brien, T. F.
O'Brien, William
O'Day, John J.
Odenkirk, H. B.
O'Hara, Charles
O'Hara, Lawrence
O'Leary, Dennis
Oliphant, B. C.
Oliver, C. E.
Olmsted, J. F.
O'Neill, Chas.
Ostermaier, John
Ostrye, P. L.
Owens, Charles
Palm, C. J.
Palmer, J. F.
Paris, A. J., Jr.
Paris, H. J., Jr.
Parker, R. N.
Patterson, T. H.

Patterson, R. L.
Payne, Christy
Peck, W. H.
Peddicord, T. B.
Penhale, J. W.
Perdue, J. L.
Perry, J. S.
Pew, James G.
Pew, John G.
Pfeifer, A. S.
Phillips, C. C.
Phillips, Henry T.
Phillips, John
Pick, Earle
Poole, C. J.
Pope, Worden
Porterfield, H. C.
Porterfield, R. M.
Powers, Nicholas
Pratt, C. E.
Preston, S. C.
Pryor, F. B.
Purdy, J. H.
Quay, H. A.
Quinlan, A. J.
Quinlan, P. J.
Ralston, W. S.
Ralph, Charles A.
Ramage, J. R.
Randolph, Ernest
Randolph, M. D.
Rankin, Harvey
Ratcliffe, Geo. L.
Ratcliffe, Geo. M.
Ray, Chas. M.
Reckard, G. H.
Reed, C. C.
Reed, F. L.
Reed, J. A.
Reed, J. H.
Reed, J. H.
Reed, N. W.
Reeger, Geo. B.
Reel, W. G.
Reeser, E. B.
Reeser, F. B.
Reeser, H. C.
Reeser, J. W.
Reichert, Win.
Reilly, W. J.
Renick, J. D.
Revel, Wm. H.
Rich, N. R.
Richards, W. H.
Richter, Wm. F.
Riddle, Geo. B.
Ridgway, J. L.
Riley, George N.
Roberts, C. C.
Roberts, W. T.
Robertson, D.
Robertson, D. S.
Robinson, Edwin
Robinson, H. P.
Rogers, Homer R.
Rogers, W. J.
Romano, M.
Rooney, E. S.
Ross, S. C.
Rowland, Williard J.
Rudy, F. F.
Rumbaugh, G. N.
Rupp, C. H.
Rutz, A. O.
Ryan, W. G.
Sackett, Edw.

Sample, D.
Schaffer, Chas. F.
Schaffer, Hose
Schall, H. D.
Schalek, Jno. H.
Schatzel, Geo. F.
Schull, Geo. W.
Schull, W. F.
Schiffler, W. J.
Schlosser, A. J.
Schmidt, E. F.
Seachrist, Chas. E.
Sears, C. W.
Secrest, M. F.
Sedberry, W. H.
Seice, J.
Seyffert, L. A.
Shaffer, C. B.
Shaffer, D. C.
Shannon, O. K.
Shaw, S. T.
Shay, J. W.
Shear, Robt.
Sheets, William L.
Sheppard, John C.
Sherwood, M. G.
Shinnick, George S.
Shoop, Alfred
Shoub, John F.
Shulters, W. C.
Shulters, Hoyt V.
Shuster, Z. H.
Sibley, E. D.
Silliman, Louis V.
Simmons, W. P.
Simpson, J. H.
Singleton, A. H.
Sipe, Geo. B.
Siverling, J. L.
Sloan, F. M.
Sloan, J. A.
Sloan, P. C.
Smith, A. C.
Smith, E. A.
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Smith, M. C.
Smith, R. H.
Smith, W. T.
Snoke, J. A.
Snyder, S. W.
South, W. H.
Spain, W. H.
Spicer, B. F.
Sprenkle, W. A.
Stainbrook, Chris S.
Stanick, A. E.
Steenberger, C. L.
Steele, Oliver
Stein, F. V.
Steinecker, Harry
Stephens, Thos. H.
Stephanus, E. M.
Sterrett, Louis E.
Stewart, S. B.
Stewart, William
Stitt, John C.
Stokes, D. J., Jr.
Stone, F. W.
Stotler, R. M.
Stout, Wilber
Strickler, J. P.
Streiber, Theo.
Stricker, J. P.

Stringer, Harrison
Strong, Murry
Stuchell, F. L.
Sullivan, J. H.
Sullivan, P. D.
Sullivan, T. O.
Sutton, A. I.
Swartz, J. K.
Sykes, J. D.
Taylor, E. R.
Taylor, J. W.
Taylor, N. J.
Teague, J. J.
Terry, L. B.
Thiel, Martin A.
Thomas, Edgar
Thomas, F. H.
Thompson, Wm. H.
Tibbens, V. W.
Tillotson, T. H.
Titzel, J. C.
Tomb, F. B.
Tomer, Adam
Tonkin, John B.
Tonkin, W. H.
Torrance, C. E.
Torrance, J. M.
Tracy, F. B.
Trautman, P. A.
Treleaven, S. G.
Tucker, G. C.
Turner, Lyle
Underwood, H. L.
Vallely, G. J.
Vance, Geo. B.
Vandergrift, T. T.
Voelke, L. P.
Wagner, E. E.
Wagner, E. W.
Wagoner, L.
Walker, W. O.
Wallace, J. B.
Walsh, D. C.
Walsh, H. F.
Walsh, John H.
Walsh, M. W.
Walters, C. K.
Ward, C. F.
Ward, R. W.
Watterson, Gabriel
Wearing, George E.
Weaver, S. D.
Webber, Daniel S.
Weisenberger, L. L.
Welch, W. W.
Welker, Geo. E.
Wells, Geo. C.
Wentzel, Howard W.
West, R. H.
Westcott, H. P.
Weymouth, Thos. R.
Wheelhouse, S. H.
Whitcomb, E. C.
Whitcomb, E. P.
White, David
White, I. C.
White, T. J.
Whitehead, L. K.
Wickett, Gordon D.
Wickoff, J. B.
Wilkes, R. L.
Wilkinson, S. L.
Williams, J. R.
Williams, J. H.
Williamson, E. W.
Willoughby, H.

Wilson, Henry M.
Wilson, Thos. B.
Wingard, G. H.
Wimer, F. W.
Wise, Bud.
Wittmer, Geo., Jr.
Wittmer, Geo. X.
Wittmer, Henry
Wittmer, Thos.
Wolfe, D. A.
Wonderley, W. V.
Woodworth, R. B.
Wyer, Samuel S.
Yorke, Patrick
Young, John
Young, Jno.
Young, W. H.
Young, W. F.
Zeller, S. E.
Zimerman, C. W.
Zimmerman, Geo. W.

President Cartwright: Gentlemen, the convention will please come to order. The Natural Gas Association of America is usually fortunate enough to be welcomed to the city in which its meetings are held by the chief executive of the city — the Mayor, but on this occasion we are doubly fortunate. Not only are greetings extended to us by His Honor, Mayor Armstrong, but we have the added pleasure of having an address of welcome about to be delivered to us by one of the foremost citizens of Western Pennsylvania, — a gentleman of national reputation and high standing and one who has left the imprint of his character upon much of the national legislation which was enacted during the many years he served his country so faithfully and so well in the Halls of Congress. I have the very great pleasure of introducing to you, Hon. James Francis Burke, who will welcome us to this city. (Applause).

Hon. James Francis Burke then delivered the following:

James Francis Burke.

ADDRESS OF WELCOME.

Mr. Chairman and Gentlemen of the Convention:

I have concluded this morning that I am rather a versatile citizen. At 9:30 I voted the straight Republican ticket, and at 10:30 I am making a speech for Joe Guffey. (Laughter). But they were both good causes, and having begun the day right, I shall not mar it by making any lengthy address to you this morning. My chief difficulty at this time is to find anything to say to the particular body that is meeting in this hall. There is a very close kinship, however, between the oil and the gas business of the United States and of the world, and if I know anything about the two, I presume I know a little more about the oil business than I do about the gas business. But inasmuch as you gentlemen know all about the gas business and I know a little about the oil business, we will get along for the brief space of time that I am allotted in which to address you. In fact, there is a very slight distinction between the oil and the gas business, as there was between the descriptions of two animate objects which a little boy in school was called upon to describe. The teacher called him to the black-board to write an essay on cows, and he wrote down: "Cows is animals with four legs. They drinks water and they makes milk, and that is where they differ from babies." (Great laughter and applause). Let it soak in. (More laughter and applause).

The oil business, gentlemen, I presume is older than the gas business in some respects, so far as the practical application of fuel is concerned, but the gas business, on the other hand, has done so much in the remarkably short space of time to revolutionize many things that it can not have failed to make a wonderful imprint upon the minds of those who have made any study of it. The world, from its beginning, has been a story of struggle. The world, from its beginning, has been what some men might call — so far as great enterprises that have been built up may be concerned — a great gamble, but there is no enterprise in all the history of mankind that has surrounding it a halo of romance more beautiful, more entrancing than that which attaches to the development of the oil and gas business of America.

While the dwellers in the neighborhood of the Caspian Sea worshipped at oil and gas fires for nearly twenty-five centuries before oil and gas were put into practical uses where the fire flag is floating so brilliantly and beautifully through the fields of Northwestern Pennsylvania, the development of the industry and the enterprise to which you gentlemen are devoting your lives is one of the marvels of the last fifty years.

From the time De La Roche Delion, a French Missionary, reported the discovery of oil pools "that burned like brandy" in the wilderness Southeast of Lake Erie in 1642, to the mammoth proportions and magnificent perfection attained in the development of oil and gas industries of today, is indeed a long stride, but the present age is one in which the marvelous things the world is accomplishing might be said really to be common place.

Around the early development of no great enterprise in the world's history does there hang a halo of romance equal to that which marks the rise and progress of the oil and gas business in the United States.

It was my fortune to be born under the shadows of an oil derrick in Northwestern Pennsylvania some forty-nine years ago, and I say to you gentlemen that you may scan all the pages of romance; you may make a detailed study of all the achievements of man from the time that human enterprise began until today when it has attained its splendid stage of perfection, but you will find no set of men in all the history of the world who endured more, who risked more in fortunes and lives and effort than those who went out into the wilderness, dedicated all they had to the march of progress, and found themselves at the very outposts of civilization, developing enterprises that meant ruin today and untold riches tomorrow, and when the history of sacrifices that have been made and the triumphs that have been achieved in the oil and gas fields during the last and the present centuries is finally written, no more romantic story of achievement will mark the course of history of man. What was a gigantic gamble in the early days is today a stupendous and fixed factor in the commercial life of the world. A fascinating series of incidents, of fortunes made in a day and disastrous shadows falling with the suddenness of the shades of night, mark the story that began with Drake's well at Oil Creek in 1859, down to the Great Lake View Gusher in California a few years ago. While Drake's was the most famous of all the wells in the world, it was only 69 feet deep and produced only 15 barrels per day. Yet it is the one well that all the oil and gas world of today has on the tip of its tongue. It is a long story and a thrilling tale from that time down to the discovery of the Great Lake View Gusher on the Pacific coast that gushed for a considerable length of time the greatest amount of oil of any well, averaging at least 50,000 barrels daily. But from the hour that the pioneers of this industry came from all quarters of the globe and from every section of the United States to dedicate their fortunes and their lives to the development of that great enterprise on Oil Creek and the Upper Alleghany, down to the present time, I say to you gentlemen that the trend of development that marked the course of their sacrifices and their successes is not beaten by the gold miners in the days of '49 or by the pioneers who wended their way into the wilds of Alaska through the winter snows. The story of the men who did so much to develop the oil and gas industry only needs to be read to fascinate the mind and challenge the continued attention of every student of the world's progress today.

Millions of homes are being heated and lighted, and thousands of industrial enterprises are turning their wheels in response to the fiery force that is being piped from the hills and valleys into the great centers of population in many sections of the country today. The dust begrimed city of the past, in many cases, has been transformed into the cleanest and most beautiful place in which men find abiding places, and countless devices produced by the genius of American invention are being used to aid in the economic consumption of the fuel which at the present time promises to fall far short of the world's demands in the future. No enterprises in which men are engaged in this country are more important to its commercial and industrial development than that to which you gentlemen are giving your lives and dedicating your fortunes. Those little towns that grew up in a night with the bewildering swiftness of enchantment and that disappeared in an hour before the blaze of a fire; that brought into being banks, hotels and commercial houses and created great fortunes in a single center within a week or a month and then disappeared from the face of the earth only to leave a memory, constitute a chapter in the world's achievement unlike any other in the history of man. Petroleum Center, Pit Hole, Tidioute, Titusville, Millers Town, Karns City, Petrolia, Parkers' Landing, Roxburg, St. Petersburg, Bradford, Eldrid and Bullion, are old names that live only, with one or two exceptions, in memory today. They have around them a romance that is dear to the heart of every oil man living in America today. (More applause). The dramatic days of the old oil exchange when prices rose and fell like skyrockets on Independence Day, have been superseded by a stable and substantial market. It was not only, gentlemen, a great gamble in the development of these fields, but after the fields had been acquired and the development had been perfected to a very high stage it was even a gamble after that.

To show you the progress that has been made up to the present time when we now have a stable oil and gas market in America, I need only illustrate it to you by one instance in 1861 to show you the uncertainty that attaches to the efforts and to the dedication of fortunes of men who went out to develop the industry at that time. In January, 1861, oil was selling at ten dollars a barrel, and on the 20th day of September of the same year you could buy it any place you wanted it at 20 cents a barrel. Following that, came the development of the old Oil Exchange at Oil City, at Progress Landing and in the city of Pittsburgh, and at other points which, with the development of the industry from year to year, has resulted today in a stable, substantial institution that is supplying the civilized world.

There is no commodity in America that is being shipped to so many places, that is doing so much to give power and light and development to the world, as the oil and gas industries, and especially the oil industry. That is being piped across the continent into cars that are winding their way over the hills and through the valleys of the nation. It is being transported in tank ships that are burdening the seas North, and South, and East, and West, that brought fuel in the days gone by to the Chinese pagoda, to light up the night for those who lived in far away Cathay. This is being done by interests that have developed the highest degree of perfection in modern enterprise, and whether you differ from me about it or not — because I am not going to express any opinion and I know there are differences of opinion as to the virtues and vices of the great Standard Oil Company of the past and of the present, I am not in any way promoting its interests or condemning its existence, — but I say to you gentlemen that I sat for three days, while a member of the Congress of the United States, before the Supreme Court of the United States, the most dignified and learned tribunal in all the world, during the time that the Standard Oil controversy was before it which resulted in its dissolution, and I say to you — not as a legal matter and not as a business matter, but as a matter of sentiment that the story told for almost one full day by John G. Milburn to the nine Justices of the Supreme Court, of the development of the oil industry of America was one of the most enchanting stories that ever fell upon the ears of man, and the men and women too in that body and in that chamber who knew nothing about the development of the oil and gas industry of America sat enraptured in the presence of a story that told of the wreck and ruin of thousands of fortunes, and the building up of untold riches in many cases. It was a story of trial, tribulation and defeat; it was a story that began with the development of the first oil well, down to the present state of the business and illustrated the perfection to which the great companies — the Standard and the independent companies of today have attained at the present time.

While a member of the Congress of the United States, it was also my pleasure, through the courtesy of gentlemen like Mr. Guffey and a number of independent oil and gas men throughout Western Pennsylvania and in Oklahoma, to assist in the fight in the Congress of the United States for a countervailing duty on oil for the protection of that industry in the United States, and during the time that controversy existed, there never appeared before a committee of Congress a better informed set of, men than were produced by the oil industries of the United States who were arguing their cause from time to time as that controversy lasted. It was a matter of sentiment to me because, as I say, it was my privilege to be born in Petroleum Center, near the oil fields of that territory in the height of their glory, and in spite of the fact that I was born there at that time, I may say the field continued to be developed and other men grew rich.

Now here I am, gentlemen, this morning, in the center of the greatest industrial city in the world, and I may say when an office boy in 1883 — I believe it was — in one of the prominent law offices of this city, it became my duty to copy certain articles of agreement, and the most important one that had ever come to my lot to put my pen to was the contract that brought natural gas into this city from the fields of Washington County, when old Captain Ford laid the line across the Western border of the city and brought it into the Southern section of this community. And it was not long after that until Mr. Westinghouse struck his great gas well in the rear of his property and which challenged the attention of the commercial world. There was then organized what was known as the Philadelphia Company. It was a natural gas company in those days. It was not successful until territory was acquired, until new fields were brought under its control, and it was then that that great pioneer,—that great soldier of fortune who had sunk as many fortunes as he had made in the oil and gas fields of the country, Colonel J. M. Guffey, came down from Buffalo with about 500 leases covering the old Westmoreland territory and territory in other sections adjacent to the city of Pittsburgh, and they were turned over in a body to George Westinghouse and his associates. And that was the beginning of the development of the Philadelphia Company. I believe, as I said, there were fully 500 of these leases, and on the transfer of each of these leases which are on record in the Recorder's Office of Allegheny County, there is to-day the name at the bottom "J. M. Guffey," and side by side with his name was that other great American capitalist, "James F. Burke," signed as a witness. (Great applause and laughter). So you can see that almost from the time of my birth I also have had something to do with the development of the oil and gas industry in this section, and from my early youth I had something to do in bringing natural gas into the city of Pittsburgh. (Renewed laughter and applause).

Seriously speaking, however, I mention these instances merely to illustrate the precarious experiences through which the great soldiers of fortune who have developed the oil and gas industries of this country have passed in the years gone by, and the rocky road over which they have traveled with the success that always marks the path-way of the real, courageous soldiers of fortune. From the beginning the development has gone on until it has reached a stage of perfection with which all of you are familiar.

I shall not trespass upon your time to detail the accomplishments of those who have given so much to the development of these industries. My purpose this morning is to welcome you to the city of Pittsburgh,—you from the West, and East, the North and the South.

We have a beautiful city, made more than ever beautiful by the introduction of natural gas; made more prosperous than ever by the introduction of natural gas; made more potential in the markets of all the world by the introduction of natural gas, which to-day is enabling us to send the products of our genius and of our manufacturing enterprises to all the quarters of the globe. And because of that I am grateful to the men who are developing that enterprise throughout this country. Gentlemen, the gates of our city are open to you; our temples of art are open to you; our shrines of religion are open to you; our courts of justice are open to you, and in conclusion I may say that even our police courts are open to you. (Applause). We welcome you and hope you will enjoy your stay with us. I thank you. (More applause).

President Cartwright: We will now have the pleasure of listening to Mr. Christy Payne, who will respond on behalf of our association to this very generous welcome extended to us by Mr. Burke, on behalf of the city of Pittsburgh. (Applause).

Mr. Christy Payne of Pittsburgh, Pa., then delivered the following:

CHRISTY PAYNE.

RESPONSE TO ADDRESS OF WELCOME.

Mr. President, and Members of the Natural Gas Association of America:

It is pleasing to us all to hear the city's distinguished spokesman welcome this convention to Pittsburgh, and to listen to his testimonial of the contributions made to the city's industrial greatness by the natural gas industry. But remembering the enthusiasm with which last year's Cincinnati convention selected this city for this 1916 convention, and anticipating that you, as grateful guests of the city, desire to show due appreciation of your host, especially since your host occupies the topmost position among cities of manufacturing renown, I am constrained to believe that you are not content to let this occasion pass with mention only of the indebtedness which Pittsburgh owes to the natural gas industry, but that it would be unpardonable not to recount the great things which Pittsburgh has done for the welfare of your industry.

Assuming that this assembly is made up for the most part of men of middle age, 40 years or thereabouts, — which is probably more or less flattering, — the record of Pittsburgh's first investments in natural gas goes back beyond the memory of this convention and this business generation.

Some of the members of this association had a part in the introduction of natural gas into Buffalo in the month of December, 1886, and remember the event well.

But early as was the Buffalo project, Pittsburgh had already been enjoying natural gas for over four years, and vast quantities of gas were being used, both in residences and in mills and glass factories.

Pittsburgh was thus the first great city to brave and to solve the problem of the control of high pressure in distribution pipes traversing the streets of a crowded city, overcoming the complications of street cars and street car tracks, telegraph lines, complex water and sewer plants, bridges, paved streets and traffic congestion. With the first special ordinance granted to a natural gas company June 19th, 1882, Pittsburgh's business men began to lead off to break the trail for this new type of venture.

Between 1882 and 1885 six special ordinances granting franchise rights to natural gas companies were enacted, but a wise move that did much to hasten the piping of all parts of the city was the action of the city councils in the enactment in 1885 of a general ordinance admitting all natural gas companies into the city on terms of equality and without the formality of a special franchise ordinance. This general ordinance was somewhat polished into working shape by decision of the State Supreme Court and being left in that form by councils, it thereupon became the model for many other cities which wisely followed the lead of Pittsburgh quickly and freely gave admission to all companies. I speak of this because it was in such marked contrast both in method and in the achievement of immediate as well as permanent good to the community, to the long periods of wrangling covering months and years when ordinances were asked for in St. Louis, Kansas City, Altoona and other places. Pittsburgh realized from the first that delay meant deprivation to the consumer.

Another of these broad gauge business policies that worked to the benefit of the industry, was the tolerant attitude with which the city faced the efforts of the natural gas men to improve the methods of measuring service. The companies started here with the flat rate charge per fire and upon the inevitable discovery that this invited intolerable waste, Pittsburgh endured with patience the successive improved steps — the flange set in the cellar with an opening in the orifice, gauged according to the cubical contents of the house, ⅛ inch being the diameter of the orifice for the house using $10.00 worth of gas per year, 5/32 inch for the house using $15.00 worth per year, and so on; finally the meter large enough for the measurement of gas used for cooking and heating was found adaptable and Pittsburgh quickly and quietly submitted, realizing that accurate measurement was vital to the conservation of the natural deposits. In this the city set an example of wise dealings to all cities. How much comfort and how many thousands of the Hoosier State's good money would have been saved if Indianapolis and other Indiana cities had followed this example!

Pittsburgh men took the lead in the movement in 1890 to conserve a failing field; this is recounted in Crum's Romance of Petroleum and Gas which I quote because of the important event which it chronicles:

> "In 1890 the field pressure of gas declined rapidly and the supply of gas to Pittsburgh began to fail. Many engineers among them were Mr. George Westinghouse, and the officers of the Philadelphia Company, as well as Mr. J. N. Pew, then President of The Peoples' Natural Gas Company, considered the question of supplementing the output of the wells by various devices, such as building large storage tanks, increasing the size of pipe lines, etc. To Mr. J. N. Pew belongs the credit of conceiving the idea of handling natural gas by means of pumps. He experimented in a small way in Wilkinsburg, and his theories being justified by the experiment, he ordered from the Hall Steam Pump Company the first commercial gas compressing station. The station was located in the Murrysville field and delivered gas to Pittsburgh."

These two things have been a great boon to the natural gas trade.

And now in later years Pittsburgh continues to take the lead in many novel activities; — the introduction of the orifice meter for accurate measurement of large volumes of gas at high pressures; the building of welded pipe lines; the use of the welding process in place of the screw joint casing; the processes of naptha saving; the invention and use of the natural gas torch for cutting iron and steel; the maintenance of two great universities in which data is collected in chemical, laboratory and engineering experiments helpful to the natural gas industry; the drilling of the deepest well in the world in which the drill has penetrated and is now working at 7120 feet, far below the horizon where men were wont to locate the eternal fires of the gas man's hereafter.

As in engineering, so also in the invention and manufacture of machinery and appliances of the oil and gas business, Pittsburgh brains have been great contributors to progress. Starting with the famous Drake well in '59, for which the boiler and engine were from Pittsburgh made by W. M. Faber & Company and called "Long Tom," Pittsburgh has supplied machinery and appliances, regulators, proportional meters, tubing, casing and line pipe, and miscellaneous house appliances, until its trade in these items of the business extends all over the world and supplies a very large percentage of the demands of the natural gas producer and user.

So in financing, too, Pittsburgh has been and is now the center of capital invested in natural gas enterprises. It is not now the frenzied speculation of Pithole days; on the contrary Pittsburgh can look with considerable amusement and complacency upon the flood of easy money that now rewards the succulent stock scheme in New York, Philadelphia or Baltimore, providing there is a flavor of oil or gas in the prospectus. Pittsburgh's present interest in the gas business is very keenly in sympathy with the aim and ideals of this association — it is largely that of an urgent and earnest effort to establish the industry upon a firm, efficient, economical foundation from which it can hold its head high among the public service enterprises of the country and be adjudged in the public view of the consumer, the land owner, the public service commissioner and the investor, as one of the most beneficient and honorable businesses in all of the world's affairs.

It is very fitting, therefore, even as natural gas men have for 34 years been turning to Pittsburgh for the solution of their troubles and for the demonstration of successful investments and satisfactory service, so now in this year of promised prosperity in the business, when this association is acquiring a magnitude and cohesion in membership and momentum in force of influence, surpassing all previous years, that it should be enabled to meet here in Pittsburgh, and in enjoying the hospitality of the city, take every opportunity of acknowledging its debt to the city for past leadership as well as for present kindness. (Applause).

PRESIDENT CARTWRIGHT: Gentlemen, we will now proceed with the regular order of business, and the next order of business is the reading of the minutes of the last meeting. These have been published, and the Chair would be glad to entertain a motion that the reading of the same be dispensed with, which is customary, I believe.

MR. JOHN M. GARARD: Mr. President, I move that the reading of the minutes of the last meeting be dispensed with, as they have already been published and no doubt all of the members have a copy of the same.

MR. J. C. MCDOWELL: I second the motion.

And thereupon the motion to dispense with the reading of the minutes of the last meeting, having been duly seconded, was unanimously adopted.

PRESIDENT CARTWRIGHT: The next regular order of business is the report of the Board of Directors.

Mr. T. C. Jones then read the following:

REPORT OF THE BOARD OF DIRECTORS.

PITTSBURGH, May 16, 1916.

To the Natural Gas Association of America.

GENTLEMEN:—Your Board of Directors beg leave to submit for your consideration the following recommendations and report:

Nominating Committee: James T. Lynn, T. O. Sullivan, O. K. Shannon.

Committee on Next Place of Meeting: Raymond Cross, Arthur Booth, John R. Munce.

Auditing Committee: C. H. Rupp, G. W. Ratcliffe, Jno. B. Tonkin.

Committee on Memorials: B. C. Oliphant, Chairman, J. G. Hanks and A. J. Diescher.

Committee on Final Resolutions: R. G. Altizer, M. W. Walsh, and A. W. Leonard.

That the following be released from Membership at their own request: A. E. Ballin, B. H. Batte, Richard Benton, C. W. Block, J. M. Bridges, C. L. Clark, J. H. Dunkel, Gano Dunn, W. H. Fellows, G. F. Fleming, W. B. Foshay, J. L. Fulton, W. H. Hammon, Wm. Kane, E. B. Kellogg, Fenton Kelsey, W. J. Killoran, K. D. Klomm, M. Lezius, F. V. Mallery, S. Mountain, F. F. Murray, J. F. Owens, I. B. Reed, H. W. Richards, Dan. Roesch, P. Silmon, B. S. Walters, A. E. Ward, and J. P. Wright.

That the following be dropped from Membership for nonpayment of dues: C. H. Anderson, P. H. Bailey, B. T. Bechtel, T. Blaine, E. Borcea, H. Branch, J. A. Brake, J. Brann, J. R. Brummett, T. T. Bryen, M. R. Bump, P. V. Brynes, M. Cannon, W. C. Carey, F. L. Chase, M. B. Clavis, J. H. Cristie, W. L. Davidson, W. H. Denney, J. H. Diamond, P. C. Dings, D. M. Donehue, J. J. Donovan, S. A. Dunbar, W. C. Dunlap, R. E. Eakin, T. H. Foley, C. Fitzgerald, T. W. H. Flinn, J. F. George, J. C. Gibson, G. C. Glynn, S. E. Hafer, F. L. Hall, K. W. Ingham, C. S. James, J. E. Jones, R. K. Jones, A. D. Jordan, J. W. Lapham, J. F. Lawrence, A. G. Liddle, H. H. McCall, J. E. McClintock, D. P. McMahon, D. D. Molloy, R. D. Morris, H. E. Myers, C. Orghudan, J. W. Piatt, J. F. Phillips, F. Z. Pride, H. T. Gause, F. W. O'Neill, C. A. Roberts, H. C. Ross, H. B. Scott, J. W. Smith, L. Stevens, A. T. Sticelbar, J. H. Stinson, J. B. Swift, C. H. Thorp, C. P. Schatzel, H. J. Truxcott, H. D. Turney, A. M. Willman, E. C. Weisgerber, W. R. Walker, G. A.

Whitney, G. Whysall, M. Wielezynski, H. O. Williams, and W. A. Williams.

Respectfully submitted for the Board of Directors,

W. Y. Cartwright, *President,*
T. C. Jones, *Secretary.*

President Cartwright: Gentlemen, you have heard the report of your Board of Directors. What shall be done with it?

(No response).

Don't be so modest. What shall be done with it?

Mr. J. H. Maxon: Mr. President, I move that the report of the Board of Directors as submitted be received, filed and ordered spread upon the minutes of the Association.

Mr. John McMillen: I second the motion.

And thereupon the above motion, having been duly seconded, was unanimously carried and the report of the Board of Directors was received, filed and ordered spread upon the minutes of the Association.

President Cartwright: The next order of business, gentlemen, is the report of the Secretary and Treasurer.

Mr. T. C. Jones then submitted the following:

REPORT OF THE SECRETARY AND TREASURER.

To the Natural Gas Association of America.

Gentlemen:—I have the honor to present herewith the Annual Report of the Secretary and Treasurer, for the year ending May, 1916.

MEMBERSHIP REPORT.

Honorary Members—		
As per Membership Rolls, May 18, 1915..........	9	
Died during the year..............................	1	
Total		8
Active Members—		
As per Membership Rolls, May 1, 1915...........	816	
Elected May 18, 1915............................	187	
		1,003

Released from Membership, May 18, 1915	118	
Died during the year	7	
		125
Total		878
Total Membership this date		886

FINANCIAL REPORT.

RECEIPTS.

Balance, May 1, 1915	$2,568 68
Dues	3,325 00
Initiation fees	925 00
Books of Proceedings, sold	25 00
Badge, sold	3 00
Total	$6,846 68

EXPENDITURES.

Printing and Stationery	$1,729 13
Stenographic Report, Tenth Annual Meeting	166 70
Clerical Assistance	57 45
Salary, Secretary-Treasurer	1,000 00
Wrinkle Department, Prizes	100 00
Dues Refunded	10 00
Postage, Express and General Expenses	556 26
Balance on hand, in Delaware Savings Bank	3,227 14
Total	$6,856 68

Respectfully submitted,
T. C. JONES,
Secretary-Treasurer.

PRESIDENT CARTWRIGHT: Gentlemen, you have heard the report of the Secretary and Treasurer. What shall be done with it?

MR. KAY C. KRICK: Mr. President, I move that the report of the Secretary and Treasurer be accepted, placed on file and ordered spread upon the minutes.

MR. J. C. MCDOWELL: I second the motion.

The above motion, being duly seconded and carried, the report of the Secretary and Treasurer was accepted, placed on file and ordered spread upon the minutes of the Association.

President Cartwright: I will now call for the report of the Auditing Committee, of which C. H. Rupp is Chairman.

Mr. C. H. Rupp then read the following:

REPORT OF THE AUDITING COMMITTEE.

Pittsburgh, May 16, 1916.

To the Natural Gas Association of America.

Gentlemen:—Your Auditing Committee has audited the books, accounts and statements of the Secretary and Treasurer, for the year ending May 1st, 1916, and find the report to be correct.

The membership of the organization having increased to such an extent your Committee respectfully suggests that the report of the Secretary-Treasurer be made to include a statement of Assets and Liabilities in addition to the present statement of Receipts and Disbursements.

We have also examined the Indemnity Bond of the Secretary-Treasurer, issued by the United States Fidelity and Guaranty Company, Baltimore, Maryland, to the amount of $3,000.

C. H. Rupp,
J. B. Tonkin,
G. W. Ratcliffe,
Committee.

President Cartwright: Gentlemen, you have heard the report of the Auditing Committee. What is to be done with it?

Mr. James T. Lynn: I move, Mr. President, that the report of the Auditing Committee be received, adopted and spread upon the minutes.

Mr. J. C. McDowell: I second the motion.

And thereupon the above motion, having been duly seconded, was unanimously carried and the report of the Auditing Committee was received, adopted and ordered spread upon the minutes of the Association.

President Cartwright: We will now have the report of the Committee on New Members, of which Mr. Hoover is Chairman.

Mr. H. J. Hoover, Chairman of the Committee on New Members, then submitted the following:

REPORT OF COMMITTEE ON NEW MEMBERS.

Mr. President, and Members of the Natural Gas Association of America:

The Committee on New Members begs leave to report that there is in the hands of the Secretary a list of applications for membership to the number of three hundred ninety-nine (399). I would suggest that the reading of these names be dispensed with, as they have all been properly vouched for, and that they be voted upon as a whole and in that way elected to membership in the Association.

PRESIDENT CARTWRIGHT: Do you make a motion to that effect?

MR. HOOVER: Yes.

MR. MARTIN B. DALY: I second the motion.

PRESIDENT CARTWRIGHT: I presume the motion carries with it that the vote of the Association shall be cast by the Secretary as usual?

MR. HOOVER: Yes. I move that the report of the Committee be received, accepted and placed on file, and that the Secretary be directed to cast the ballot of the Association for the election to membership in the Association of the applicants recommended by the report of the Committee on New Members.

MR. LUCIUS S. BIGELOW: I take great pleasure in seconding that motion.

And thereupon said motion being duly seconded, was unanimously adopted.

SECRETARY JONES: Mr. President, and Members of the Natural Gas Association of America; Complying with the motion just adopted, it gives me great pleasure to cast the ballot of the Association for the election to membership of the applicants whose names are submitted with the report of the Committee on New Members. I now do so cast the ballot of the Association for the election of each and all of said applicants to membership, and with your permission I do now declare them duly elected to membership in our Association and extend to them a cordial invitation to actively participate in all future proceedings.

The highest number of new members we have ever had before was at the Cincinnati meeting last year, where we took in 187 new members. With a new membership list of four hundred and four, this breaks all previous records.

The list of applicants reported by the Committee on New Members and now duly elected members of the Association, is as follows:

NEW MEMBERS.

Walter Abbe, Jr., Chief Engineer, The Peoples Natural Gas Company, Pittsburgh, Pennsylvania.

C. G. Abbott, Comm. Agt., The Springfield Gas Company, Springfield, Ohio.

J. A. Adams, Field Superintendent, American Natural Gas Company, Cowansville, Pennsylvania.

W. H. Adams, Logan Natural Gas & Fuel Company, Ashland, Ohio.

Wm. M. Adams, Logan Natural Gas Company, Elyria, Ohio.

Hugh Anderson, Assistant Foreman, The Manufacturers Light & Heat Company, Reader, West Virginia.

J. F. Anderson, Field Foreman, The Peoples Natural Gas Company, Mayport, Pennsylvania.

W. H. Arras, Chief Clerk, Purchasing Department, Philadelphia Company, Pittsburgh, Pennsylvania.

Wm. A. Ashley, Logan Natural Gas & Fuel Company, Chillicothe, Ohio.

A. G. Baker, Superintendent, Tri-County Natural Gas Company, Caledonia, New York.

Chas. E. Baker, Field Foreman, The Manufacturers Light & Heat Company, Wallace, West Virginia.

W. N. Baker, Foreman, Hope Natural Gas Company, Miletus, West Virginia.

George S. Barrows, Manager Gas Heating Department, General Fire Extinguisher Company, Providence, Rhode Island.

James Barry, Foreman, Arkansas Natural Gas Company, Prescott, Arkansas.

John C. Bartlett, Secretary and Treasurer, Oklahoma Natural Gas Company, Pittsburgh, Pennsylvania.

H. J. Bartley, Field Superintendent, American Natural Gas Company, Indiana, Pennsylvania.

W. A. Bartley, District Superintendent, American Natural Gas Company, Indiana, Pennsylvania.

Ralph A. Beach, Assistant to Superintendent, T. W. Phillips Gas & Oil Company, Butler, Pennsylvania.

H. P. Beans, District Superintendent, American Natural Gas Company, Indiana, Pennsylvania.

R. D. Beardsley, Assistant Treasurer, Hope Natural Gas Company, Pittsburgh, Pennsylvania.

Elmer Beatty, Manufacturers Gas Company, Bradford, Pennsylvania.

D. J. Beckett, Field Superintendent, American Natural Gas Company, Cabot, Pennsylvania.

A. C. Bedford, President, The Peoples Natural Gas Company, Pittsburgh, Pennsylvania.

Geo. K. Benner, Benner Drill & Tool Company, Pittsburgh, Pennsylvania.

J. E. Billingsley, Assistant Geologist, Philadelphia Company, Pittsburgh, Pennsylvania.

Jas. B. Black, Agent, The Manufacturers Light & Heat Company, Canonsburg, Pennsylvania.

Tom M. Black, Assistant Secretary, T. W. Phillips Gas & Oil Co., Butler, Pennsylvania.

William Blum, Logan Natural Gas & Fuel Company, Lancaster, Ohio.

Wm. Boice, Field Superintendent, American Natural Gas Company, Sarger, Pennsylvania.

C. W. Boocks, Foreman, Hope Natural Gas Company, Hastings, West Virginia.

Clarence B. Borman, Engineer, Carnegie Natural Gas Company, Washington, Pennsylvania.

J. Bossert, Field Superintendent, American Natural Gas Company, Allison Park, Pennsylvania.

J. O. Bothel, District Superintendent, American Natural Gas Company, Leechburg, Pennsylvania.

Eugene Braden, Contractor, Aidizzone Braden Company, Tulsa, Oklahoma.

Henry Brewster, Foreman, Hope Natural Gas Company, Weston, West Virginia.

R. W. Brink, General Auditor, Hope Natural Gas Company, New York, N. Y.

Cameron Brown, Campaign Manager, General Gas Light Company, New York, N. Y.

Wm. Laird Brown, Helme & McIlhenny, Philadelphia, Pennsylvania.

James I. Buchanan, President, Taylortown Natural Gas Company, Pittsburgh, Pennsylvania.

J. F. Bulger, Shop Foreman, The Peoples Natural Gas Company, Turtle Creek, Pennsylvania.

Ira S. Burford, Agent, United Fuel Gas Company, Inc., Ironton, Ohio.

A. R. Burnett, District Superintendent, American Natural Gas Company, Zelienople, Pennsylvania.

T. P. Burns, Shop Foreman, Hope Natural Gas Company, Parkersburg, West Virginia.

S. E. W. Burnside, Attorney, Hope Natural Gas Company, Wilkinsburg, Pennsylvania.

F. G. Burson, Field Foreman, The Manufacturers Light & Heat Company, Proctor, West Virginia.

H. W. Burson, President, Colonial Supply Company, Pittsburgh, Pennsylvania.

James C. Burtner, Gas Well Contractor, Burtner & Morgan, Wooster, Wayne County, Ohio.

J. P. Campbell, Foreman, Hope Natural Gas Company, Littleton, West Virginia.

J. T. Campbell, Agent, The Manufacturers Light & Heat Company, New Castle, Pennsylvania.

M. L. Campbell, Pittsburgh & West Virginia, Salem, West Virginia.

Geo. R. Carpenter, Superintendent, United Fuel Gas Company, Charleston, West Virginia.

David J. Carter, Attorney at Law, Carter and Sheets, Clarksburg, West Virginia.

O. M. Carter, President, United Gas Iron Company, Chicago, Illinois.

T. R. Cartwright, Superintendent, United Fuel Gas Company, Clendenin, West Virginia.

O. W. Cashdollar, Claim Agent, American Natural Gas Company, Pittsburgh, Pennsylvania.

A. T. Casto, Superintendent, Randall Gas Company, Morgantown, West Virginia.

Charles Cavenau, Foreman, Reserve Gas Company, Wilsonburg, West Virginia.

W. B. Chapman, Oil Producer, Pittsburgh, Pennsylvania.

Robert E. Clark, Chief Field Agent, Philadelphia Company, Pittsburgh, Pennsylvania.

J. E. Conley, Field Superintendent, American Natural Gas Company, Glenshaw, Pennsylvania.

A. F. Coulter, Field Superintendent, American Natural Gas Company, Apollo, Pennsylvania.

C. F. Covey, Treasurer, McAuley Automatic Trap Company, Pittsburgh, Pennsylvania.

Albert B. Craig, Geologist, Greensboro Gas Company, Pittsburgh, Pennsylvania.

A. A. Crawford, Manufacturers Gas Company, Bradford, Pa.

C. J. Crawford, 1028 Liberty Street, Franklin, Pa.

C. F. Critchfield, Special Inspector, The Ohio Fuel Supply Co., 52 West Gay St., Columbus, Ohio.

G. A. Crosby, Superintendent, Land Department, Potter Gas Company, Farmers Bank Building, Pittsburgh, Pa.

M. C. Crum, Agent, The Peoples Natural Gas Co., Monessen, Pa.

Henry Cummings, Field Foreman, The Manufacturers Light & Heat Co., McDonald, Pa.

M. J. Cummings, Field Foreman, The Manufacturers Light & Heat Company, Cameron, W. Va.

R. H. Cunningham, Sales Engineer, Ingersoll Rand Company, 1226 Farmers Bank Building, Pittsburgh, Pa.

M. B. Cypher, Contractor and Producer, Marwood, Pa.

Stuart W. Davies, Information Department, Calgary Gas Company, Limited, 215 Sixth Avenue, West Calgary, Alberta, Canada.

William B. Davies, Assistant Superintendent, Alden Batavia Gas Co., Batavia, N. Y.

Merrill N. Davis, Salesman, The B. F. Goodrich Company, Akron, Ohio.

Silas Davis, Engineer, The Manufacturers Light & Heat Company, Wallace, W. Va., R. F. D. No. 1.

H. Alexander Dean, President, Elk Natural Gas Company, 233 Fourth Avenue, Pittsburgh, Pa.

F. C. Derricks, Ind. Producers, Clarksburg, West Virginia.

C. R. Dietrich, Agent, The Peoples Natural Gas Company, Turtle Creek, Pa.

L. R. Dingman, District Foreman, Equitable Gas Company, Second Street, Braddock, Pa. .

Wm. A. Ditto, Superintendent, Bradford Gas Company, Roulette, Pa.

P. E. Dixon, District Superintendent, American Natural Gas Company, Ford City, Pa.

R. F. Dolen, Foreman, Pittsburgh & West Virginia Gas Company, 965 W. Pike Street, Clarksburg, W. Va.

William E. Donnelly, General Superintendent, Northeastern Oil & Gas Company, Geneva, Ohio.

F. D. Dougherty, Superintendent Gas Wells, William Harris Company, Wooster, Wayne County, Ohio.

W. J. Droppleman, Foreman, Hope Natural Gas Company, McWhorter, West Virginia.

C. S. Duffield, Purchasing Agent, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Carl Cyrus Dunham, Meters Department, Pittsburgh & West Virginia, Gas Company, No. 3 Center Avenue, Westen, W. Va.

D. F. Dusenberry, Gas Engineer, West Virginia Traction and Electric and City and Suburban Gas Company, 298 Wiles Street, Morgantown, W. Va.

James P. Eagleson, Director, Manufacturers Light & Heat Company, 6 S. Main, Washington, Pa.

S. H. Eastland, District Foreman, Philadelphia Company, 23rd & Main Street, Sharpsburg, Pa.

William C. Edwards, Vice President, Parker & Edwards Oil Company, Union Bank Building, Pittsburgh, Pa.

E. J. Egan, Agent, The Manufacturers Light & Heat Company, Milbridge and Manton Streets, Pittsburgh, Pa.

J. J. Ewing, House Piper, Own business, 952 Fifth Avenue, Coraopolis, Pa.

J. W. Farner, Superintendent, Potter Gas Company, Port Allegany, Pa.

H. F. Finley, Logan Natural Gas & Fuel Company, Tiffin, Ohio.

Claude M. Fleming, Foreman, Holpe Natural Gas Company, 202 Locust Street, Mannington, W. Va.

Curtis B. Fleming, Producer Oil and Gas, Private, Fairmont, W. Va.

Jno. A. Fletcher, Agent, The Manufacturers Light & Heat Company, Bellaire, Ohio.

T. W. H. Flinn, Appliances, Flinn Appl. House, 607 W. Main Street, Denison, Texas.

Alfred F. Flocken, Bookkeeper, Union Gas & Electric Company, 2241 Loth Street, Cincinnati, Ohio.

T. B. Foley, Contractor, T. B. Foley, 410 Diamond Bank Building, Pittsburgh, Pa.

T. H. Foley, Superintendent for T. B. Foley, Contractor, 410 Diamond Bank Building, Pittsburgh, Pa.

Geo. Fonner, Field Superintendent, American Natural Gas Company, Gibsonia, Pa., R. F. D.

J. H. Fonner, Shop Foreman, The Peoples Natural Gas Company, Midland, Pa.

I. D. Frantz, Foreman, Hope Natural Gas Company, Smithville, Virginia.

W. H. Free, Rig Builder, 136 East Benman Street, Wooster, O.

C. W. Gardner, The East Ohio Gas Company, Cleveland, O.

Dr. J. B. Garner, Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pa.

M. J. Garrity, District Foreman, Equitable Gas Company, 9th Street, McKeesport, Pa.

F. L. Garard, Assistant Superintendent, Fayette County Gas Company, 62 Wilson Avenue, Uniontown, Pa.

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President Cartwright: Mr. Guffey, let me ask you to take the Chair please.

Mr. Joseph F. Guffey, Vice-President, then assumed the President's Chair, amid generous applause.

Mr. William Y. Cartwright then delivered the following:

PRESIDENT'S ADDRESS

William Y. Cartwright.

Gentlemen of the Convention:

Pennsylvania was the birthplace of the natural gas industry, and Pennsylvanians have had much to do with, and are responsible to a considerable extent for the great development and progress made in the natural gas industry during the past thirty years. The metropolitan district of Pittsburgh is now the greatest gas consuming section in the world, so it seems very fitting that the Natural Gas Association of America should return to this city for its Eleventh Annual Convention, and as much of the prosperity of this wonderful industrial community is due to the use it has made of natural gas, it seems entirely probable that our membership will take a keener interest in the proceedings of this convention than if it was held elsewhere.

Following in the footsteps of the previous Presidents we have consulted from time to time with the Directory and Advisory Committee of the Association, calling them together in this city on two occasions for the purpose of securing their advice and discussing matters pertinent to the welfare of the Association. Much good has come from these gatherings, and it is to be hoped in the future that these meetings can be held more frequently throughout the year, thus distributing the work and interest in the Association during the year instead of forcing all the activities into a few months or weeks prior to the Convention.

During the past year splendid work has been done by the standing committees, and I desire to direct your attention particularly to the high class of this year's committee's reports, which will be submitted during the present meeting. At the same time I want to express my appreciation to the Chairman and members of these committees for the excellent manner in which the work has been carried out. As our Association grows in strength and usefulness, as I feel confident it will from year to year, more dependence must be placed on these committees and others that will be appointed from time to time, composed of men who will gladly give their time and thought to the development of the industry.

By the use of these permanent committees, the membership of which should be selected with a view of securing those best adapted by education and training, much good can be accomplished, not alone to the Association, but also to the individual members of these committees. By securing for these committees men highly trained in certain branches of the industry it will be possible to derive benefits from the work they will do that could not be secured otherwise. If a bulletin is issued, as should be by this Association, much of the work that is done from time to time by these committees, could be published monthly in it, and thereby advance information would reach the membership long before the annual convention.

The Uniform Accounting Committee has done an immense amount of work during the past year, and the report which they will submit to this convention will be exhaustive and painstaking, and will have much to do with unifying this important department of the industry. Numerous meetings have been held by this Committee, and on several occasions they have consulted with experts appointed by the several State Public Utility Commissioners of the Middle West. The gentlemen composing this committee have given their best time and thought at these numerous conferences, and have sacrificed their personal time for the benefit of the Association and its members, and much credit must be given them.

The Committee on Rates will have an interesting report to make to the Association, and it would appear that the scope of this Committee can be very greatly widened in the future, as the rate question is probably the most vital one that the Association will have to do with now in the future. There is a very great diversity of opinion as to the proper basis for natural gas rates and schedules, and much good can be accomplished by future rate committees if they will aim to uniform rate systems? The so-called "sliding scale," minimum charge, etc., should all receive careful consideration, and it is to be hoped that a sound basis can be established that will be used generally through the natural gas business in changing or making new schedules.

At the last convention Mr. Samuel S. Wyer was appointed by this Association to serve as its representative on a joint committee composed of experts from the Bureau of Standards at Washington and representatives of other gas associations, for the purpose of devising a gas safety code applicable to the gas industry generally, both natural as well as artificial. I have been rather closely in touch with the work done by our representative on this committee, and too much praise cannot be given for the intelligence, industry and ability displayed by Mr. Wyer in the protection of our interests in this very important matter, and I am quite sure that his report will be very gratifying and satisfactory to the Association, and the code, when completed, will have the hearty approval of all.

There has been three changes of editors in the Wrinkle Department during the past year. Mr. Stone, who so long and faithfully served the Association as editor, resigned, as he advised us he would be compelled to do shortly after he was elected last May, and Mr. Hutchinson, who very graciously accepted the appointment also found it necessary to give up the Chair owing to a change in business connections, so it was incumbent upon the President to appoint on short notice a new editor. We were fortunate enough in securing Mr. Brown, of Columbus, to take this responsible place, and to him and Mr. Shannon, Associate Editor, the Association owe a debt of gratitude for the splendid manner in which they handled this department.

The growth has been remarkable, and I am glad to here voice the opinion that our Wrinkle Department is probably of more real benefit to the every-day member of the Association than any other branch, and it was deemed advisable by the Directory that the wrinkles, instead of being published as part of the general proceedings of the annual meeting, should be issued under separate cover and distributed direct to the members Further, as these so-called wrinkles cover many of the knotty daily problems that confront the operators, it was decided that these pamphlets should be sold to the different companies allied with the Association for a sum practically covering the cost of printing, so they may be distributed generally through the gas industry to many men who are not members of the Association. The innovation of granting prizes for the best wrinkles, which was started last year, will be carried out this year and the monetary value increased.

These prizes have been the cause of friendly rivalry and have done much to increase the number of wrinkles. This department, however, is growing in size each year, and it would appear the work is getting to be too much of a tax upon our voluntary editors, and it is expected that in a year or two it should be handled by the Secretary's office.

The Joint Committee on Electrolysis have done quite a lot of work on their report, an outline of which will be given at this meeting, and I am sure the same will prove very interesting to our members.

The past year has been a prosperous one in the natural gas industry generally, and with this increased prosperity some progress has been made in increasing the membership of the Association. The Membership Committee has made strenuous efforts to secure new members, and their efforts have not been in vain, however, not only have some of the larger companies seen fit to increase the membership paid by them, but in some instances they have even decreased the number they have formerly held. But on the whole the net increase will probably be greater than in any previous year, but it is not what it should be.

The Association appears to have reached the milestone in its career where the adding of new members, either by direct solicitation or through the companies, is very difficult, if not entirely impossible, and some method other than attempting to increase the membership must be devised whereby the revenue of the Association may be increased. In fact there is grave doubt whether the membership can be increased in number very much beyond what it is at present. It is a self-evident fact that your Association cannot accomplish the ends it appears should be reached in the province of a National Organization unless it has an increase in its revenue.

During the eleven years that the Association has been in existence it has accomplished much good, but it has failed to keep abreast with the growth of the industry. When it was organized by that sturdy body of western gas men eleven years ago it represented an industry that had barely fifty million dollars invested in it, and was serving natural gas to but a few hundred thousand people. Today the industry has advanced to a point where there is now fully half a billion dollars invested and more than two million families depend on natural gas for light, heat and power.

The Association has an annual income of about $4,000 per year, and with that all its affairs must be conducted. It has no means of income other than the dues received from its members.

For the Association to cover the field of its usefulness it should have an income of not less than $25,000 per year. How this is to be secured is a grave problem, but it certainly cannot be done by either raising the present dues or increasing the membership.

With the hope that some definite plan could be devised and presented to this Convention, whereby this much needed revenue could be secured, a meeting was called of the Directory and Advisory Committee in January of this year, and after a thorough discussion a committee designated as the "Ways and Means committee for Increasing the Scope and Usefulness and Efficiency of the Natural Gas Association of America" was appointed. This committee consists of three of the leading men of this Association, Mr. John M. Garard, Chairman, Mr. John E. Gill and Mr. Martin B. Daly, and it will make its report at this meeting on Wednesday, the 17th, and I urgently request that every member who has the interest of the Association at heart be present when this report is presented.

I doubt very much whether any of our members, other than those who have served as Directors or on the Advisory Committee, realize the constant and insistent demands made upon the Association for assistance by operating companies. Request after request is received for data to be used in franchise matters before City Councils, rate hearings before Public Utility Commissions, etc. In some cases requests are made for data relative to the legal phases of the industry? It has been my thought that through this committee we would be able to point out to the Association some way out of this difficulty, probably by creating member companies, allowing corporations and companies interested in the industry to become contributing members of the Association, each in accordance with its income.

With the funds derived from these company memberships a permanent Secretary's office could be established. My hope is that it will be located here in the home of the industry—Pittsburg—the Secretary to be paid a salary that would permit him to devote his entire time and thought to the work of the Association. The Secretary's office to have such assistance as is necessary for the accumulation of information and data that would be of value to these member companies, and with this added income to follow out the recommendation that have been made by at least three of the past Presidents—that a monthly bulletin be issued by the Association. None of these things are possible without money, and I reiterate that not less than $25,000 a year should be secured.

With this added revenue it would be entirely possible for the National Association to become affiliated with those splendid State organizations that have sprung up in the past few years. West Virginia, with an Association barely a year old, has 2,500 members. Indiana has a live active Association, as has also Oklahoma, and we are advised that Pennsylvania and Ohio will shortly inaugurate a State organization. These State organizations co-operating with the National Association would wield a tremendous influence not only in the States in which they exist, but nationally.

Practically all of the States that are now being served with natural gas have Public Utility Commissions, and those that do not will doubtless initiate this plan of control in the early future, so the growing need of a strong central body such as your Association can be made, to assist these various natural gas companies in matters that from time to time come before these Commissions in connection with rate revisions, conduct of business, etc., is self-evident, and I trust that the Committee's report will be listened to by the largest attendance we will have at any of our sessions, and further, I urge that definite and prompt action be taken on the report, with the end in view of initiating some plan immediately. I feel quite confident that should this new plan be put in operation and carried through for a year or two with the same enthusiasm and effort that has made the Association what it has been in the past, that the member companies will gladly see that the revenue of the Association is increased to an amount where it can take its place side by side with other National organizations to the common end of securing justice and fair play for the natural gas industry.

In closing I desire to express my appreciation for all the work done by the officers and officials during the past year, and particularly do I desire to express my thanks to the Chairman and members of the several committees, who have so freely contributed their time and efforts to the work of the Association, and to our most efficient Secretary do I extend my appreciation for his untiring efforts in behalf of the Association. The President and his assistants, of the National Supply Men's Association, have done so much this year, as they have in the past, to add to our pleasure and entertainment, they, too, have my sincere thanks.

A hearty round of applause followed the reading of the President's address, after which Vice-President Guffey said:

GENTLEMEN: I am sure we are all indebted to Mr. Cartwright for his able address covering a comprehensive review of the work done during the past year, and with many suggestions outlined therein for carrying on the work of the future. What is the pleasure of the Convention with reference to this address?

MR. A. J. DIESCHER: Mr. President, I move that the admirable address of Mr. Cartwright be referred to a special committee of three for the purpose of considering the suggestions and recommendations therein contained and reporting back to the meeting later on.

MR. JOHN M. GARARD: I take pleasure in seconding the motion.

And thereupon the above motion, having been duly seconded, was unanimously adopted.

Vice-President Joseph F. Guffey then appointed the following

COMMITTEE ON PRESIDENT'S ADDRESS:

Martin B. Daly, Cleveland, Ohio, Chairman;
Jesse C. McDowell, Pittsburgh, Pennsylvania;
Alfred Hurlburt, Kansas City, Missouri.

VICE-PRESIDENT GUFFEY: The address of the President will be turned over to the Chairman of the Committee, Mr. Daly, and I trust that the three members just appointed to this Committee will consent to act in the capacity suggested.

President Cartwright, then resuming the Chair, said:

GENTLEMEN: We have with us today one of the leading scientists of the country, Dr. Van H. Manning. I take very great pleasure in now introducng Dr. Manning to you. He will address you upon the all-important subject of "The Conservation of Natural Gas."

Dr. Van H. Manning, of Washington, D. C., then read the following paper:

THE CONSERVATION OF NATURAL GAS.

VAN H. MANNING.

Two years ago at your St. Louis Convention, Dr. Holmes, the late Director of the Bureau of Mines, addressed you on the work of the Bureau, its efforts to bring about more efficient utilization of natural gas and other natural resources and the necessity of scientific, engineering, and industrial associations, the Federal Government and the several States cooperating so that work may be harmonized and the most advantageous development and utilization of our natural resources may result.

Dr. Holmes, as many of you may know, was even then very ill, but his illness did not deter him from coming to your Convention and speaking to you with great earnestness and conviction on the importance of husbanding our mineral resources, not by shutting them up in the earth, but by using them as freely as may be necessary for the good of the present generation, in such manner that succeeding generations can not look back and say, "Our fathers and grandfathers were wasteful in their use of supplies of valuable minerals which we ourselves could now be enjoying."

Upon me has fallen the duty of carrying on the work that Dr. Holmes planned and undertook with such foresight and courage. To be with you at this time, to participate in your meetings, and to become acquainted with you personally is indeed a great pleasure. That I have been invited to meet you, to learn for myself what some of your problems are, and to tell you of the work and the aims of the Bureau of Mines, is very gratifying.

The Bureau of Mines is primarily interested in seeing that our natural resources are utilized with minimum waste and maximum efficiency; and in that connection I will summarize briefly what the Bureau is doing toward the conservation of natural gas.

Notwithstanding the value of natural gas as an ideal fuel, particularly for domestic purposes, and the limited supply, which, according to estimates by authorities, will be exhausted in less than 25 years at present rates of production, no natural resource has been and is being so recklessly wasted by the American people as is natural gas. Large quantities of natural gas have been wasted by being used inefficiently, but the loss through such use has been relatively unimportant as compared with the large absolute waste that has occurred in connection with its production. This waste has been co-extensive with the growth of the industry. It culminated in the waste incident to the development of the Cushing field in Oklahoma, which was probably the most flagrant in the history of the natural gas industry. It is estimated that from 80 to 90 per cent of the gas in this field is irretrievably lost. Experienced men have estimated that this waste exceeded, at times, a billion feet a day. The total amount of gas wasted to the atmosphere alone is estimated to have exceeded 250,000,000,000 feet, enough to supply the domestic needs of a million people for eight years. Faulty methods of drilling and protecting the gas-bearing strata were largely, if not wholly, responsible for this waste.

The most serious forms of waste are open waste, which is self-evident, and underground waste, or the escape of gas, beyond recovery, from the original sand into exposed porous formations, either of which will deplete a gas field unless checked. Underground waste is not so apparent, and therefore has not generally received the remedial attention that it should receive.

Numerous examples can be cited, in practically every State producing natural gas, where gas has been permitted to waste into the air during drilling. In the Cushing field wells of 15,000,000 to 20,000,000 feet capacity were permitted to waste unrestricted into the atmosphere to reduce the pressure sufficiently to permit further drilling.

In some cases attempts were made to save the gas by confining the gas between two strings of casing by the use of bradenheads. These attempts were only partly successful, because the gas was allowed to waste during drilling, on account of possible danger to the drillers working over high pressure resulting from closing the bradenheads, and for the further reason that in many of the wells the gas is confined between the casing and the walls of the borehole. and, except when the formation happens to be impervious has been dissipated beyond recovery into the exposed formation.

Wells making large quantities of gas with oil were universally permitted to flow unrestrained into the flow tanks, and the gas, escaping into the air, carried with it considerable quantities of the gasoline.

Little, if any, concerted effort was made by the operators to protect the gas sands from water encroachment or the contents of the several from intermingling one with another. Such efforts as were made by individual properties were often rendered ineffectual by the refusal of owners of neighboring properties to adopt similar methods, their principal objection being that even if the gas was conserved it could not be disposed of, as the market was limited, and the purchasers often restricted their purchases to a few properties to the exclusion of others. In support of this contention they would cite instances where the pipe-line company was taking gas from a well on one property to the exclusion of gas from a well on an adjoining property, giving as its reason that it could not utilize and therefore could not take any more gas. It was evident that efforts requiring additional expense and delay on the part of the operators without providing a market for the gas he has helped to conserve would be not only burdensome but must eventually fail for lack of cooperation on the part of the producers.

Briefly, these were the conditions when the Bureau of Mines entered the Cushing field in 1913. The dry-hole method of drilling and the use of packers invited waste and failed to efficiently protect the several gas sands in this field. Realizing the inadequacy of the dry-hole method of drilling, the Bureau of Mines investigated the possibilities of adapting the use of clay-laden water, or "mud-fluid," as used in rotary drilling, to the drilling methods practiced in Oklahoma. Engineers were engaged to demonstrate the practicability of the method. It was to be expected that there would be some opposition from the operators and drillers to the introduction of this departure from the usual dry-hole method of drilling.

I believe it was demonstrated to the satisfaction of the operators in Oklahoma that it was practicable, by the use of mud-fluid, to drill wells through high-pressure gas sands without wasting a foot of gas, and at the same time to confine the gas, oil, and water to their respective strata, preventing loss from the intermingling of the contents of the different strata.

"Mud-laden fluid" is a mixture of water with clay, the clay remaining suspended in the water for a considerable time. The action of mud-laden fluid on gas sands or other porous formations can be likened to the action of muddy water going through a filter. In any filter that has been used for some time most of the sediment from the water will have been deposited on the surface of the filter, but some of it will have entered the filter diminishing with the distance penetrated. The distance to which clay from the fluid in the well will penetrate a porous formation depends on the pressure produced by the column of fluid, or by the pump, and also on the porosity of the formation. Some drillers have contended that clear water has the same effect as the mud-laden fluid, but the results have shown conclusively that it has not. In the first place, it weighs less, and then again many wells can not be filled with clear water, because the water continues to flow into the rock or sand without any clogging effect, and consequently does not rise sufficiently high for the pressure of the water column to overcome the gas pressure. Where clear water has been used successfully to kill the gas, it has resulted in flooding and ruining the gas sand. Clear water also has a tendency to cause the walls of the well to slack and cave, frequently "freezing" the pipe.

The action of the mud-laden fluid differs from that of water in that as the fluid enters the porous formation it deposits clay, which clogs the openings and prevents further inflow of the fluid. A full description of technical details, including cost data, of the use of mud-laden fluid in connection with dry-hole drilling, is contained in a bulletin to be issued in the near future by the Bureau of Mines.

Claims were at first made that the extra expense involved in the use of mud-fluid was not justified, but it has been demonstrated to the satisfaction of most operators that this extra expense is for the most part compensated for by the resulting saving in the amount of casing required, the protection of this casing from corrosive waters, the additional safety of the men, and by the assurance afforded that the well will be completed regardless of the gas pressure encountered, not to consider the value of the gas conserved. Some operators claim that the delay caused by drilling in a hole full of fluid places them at a disadvantage with the operator on the adjoining lease using the dry-hole method of drilling. As to this contention, there is something to be said on both sides. When the gas pressure is high, it is practically impossible to complete a well by the dry-hole method until the pressure has been reduced by wasting the gas, whereas in the mud-laden process drilling is continuous, and the same progress (24 feet per 24 hours) can be made regardless of the pressure of the gas sands. Assurance of completing a well under perfect control and the elimination of the risk of a wild well destroying itself must be considered in comparing the dry-hole method with the mud-fluid method of drilling. The operators contended that unless the efforts to conserve the gas were universally adopted, the carelessness of a few would nullify conservation efforts of the majority, and furthermore that as long as gas companies were allowed to take all the gas they wanted from one property, and none from the gas wells on an adjoining property, there could not result benefits commensurate with the expenditures.

When it had been demonstrated to the satisfaction of the operators that the proposed method was practicable, its universal adoption and a satisfactory marketing agreement were necessary before conservation could become a reality. This required the cooperation of the State Governments, and in the case of Oklahoma, of the Federal Government on the one hand and of the producers and marketers of natural gas on the other.

For the purpose of bringing about an agreement on effective legislation, the Corporation Commission of Oklahoma arranged for a conference between the executive committee of the several producers associations and the representatives of the various marketing companies. The producers were unitedly opposed to adopting any method by which extra expense was incurred unless they were assured of an equitable marketing arrangement. The marketing companies, which consisted of all the important marketers and distributors of natural gas operating in Oklahoma, realizing the fairness and the necessity of meeting the demands of the producers, agreed to become common purchasers and to prorate purchases under the supervision of the corporation Commission where the production exceeded the capacity of the transportation facilities. As a result of several conferences, during which concessions were made by both the producers and the marketers, a bill was finally agreed upon which was introduced in the legislature and passed on March 30, 1916. This act provided for the prevention of waste of natural gas, and for the equitable taking and purchase of gas from the various producers, and conferred authority on the State Corporation Commission to make the necessary rules and regulations to enforce the provisions of the act.

One of the principal features of the act was the definition of the term "waste of natural gas", which was defined as the escape of gas in commercial quantities into the open air, the intentional drowning by water of a gas stratum capable of producing gas in commercial quantities, underground waste, the permitting of any natural gas wells to wastefully burn, and the wasteful utilization of natural gas.

The provision providing for equitable taking was as follows: "Whenever the full production from any common source of natural gas is in excess of the market demands, then any person, firm or corporation having the right to drill into and produce gas from any such common source of supply may take therefrom only such proportion of the natural gas that may be marketed without waste as the natural flow of the well or wells owned or drilled by any such person, firm, or corporation bears to the total flow of such common source of supply, having due regard to the acreage drained by each well, so as to prevent any such person, firm, or corporation from securing any unfair proportion of the gas therefrom, provided that the Corporation Commission may by proper order permit the taking of a greater amount whenever it shall regard such taking as reasonable and equitable".

This provision, agreed to by the marketers of natural gas, eliminated the principal objection of the producers to conservation, as it provided a reliable market for the gas and prevented gas being taken from wells on one lease in preference to gas wells on an adjoining lease. The reference to the acreage drained by each well was to prevent an operator from drilling a large number of wells on a small tract in order to obtain an undue proportion of the production of any field. The clause granting the Corporation Commission authority to permit a greater amount of gas to be drawn from any field or any well when it could be shown that such taking was justified by the conditions, was added because there was some doubt as to the legality of the provision.

All of the purchasing companies in Oklahoma, with one exception, agreed to file a written acceptance of this provision. The demurring company declined to prorate its purchases, and obtained an injunction against the Corporation Commission, restraining the enforcement of this provision. However, this company, so I am informed, has recently agreed to prorate its purchases, and not to contest further the constitutionality of the act. The act further authorizes the commission to prescribe rules and regulations for the enforcement of the act, and provides as a penalty a fine not to exceed $5,000, or imprisonment in the county jail not to exceed 30 days, or both.

The Commission held hearings and invited suggestions, after which regulations were issued that effectively prevent surface and underground waste, by prohibiting open waste and requiring that the gas either be sealed up in the original sand by mud-fluid, or adequately protected by casing from dissipation into the formation. The State appointed three inspectors with drilling experience to enforce the regulations.

The Federal Government, acting with the State Corporation Commission, issued similar regulations effective on restricted lands, thereby making compulsory the universal adoption of efficient conservation methods on all lands in the State of Oklahoma.

As indicating how the efforts of the State and Federal Governments were received by the operators, I will call your attention to the situation in the Ada field. The operators and consumers in this field organized an association, raised sufficient money to employ an inspector, and requested the Bureau of Mines to recommend to them a competent man for the position, at the same time requesting that the State and Federal Governments direct this work and make it a part of their general plan of conservation. The Bureau is ready at all times to extend to any other State, association, or organization the same sort of cooperation that was extended to the State of Oklahoma and to the operators of the Ada field.

Prevention of waste can not be attained by legislation alone; the Government must have the cooperation of the producing and marketing companies. Oklahoma has effective conservation, not alone because it has effective laws, but because over 95 per cent of the producers and drillers in that State are cooperating to enforce the spirit of these laws, and because the marketing companies have agreed to become common purchasers and to prorate their purchases, waiving certain possible legal rights to that end.

The precautions necessary to reduce waste of natural gas to a minimum may be briefly summed up as follows:

1. Each gas-bearing stratum should be sealed as it is encountered by drilling with the hole full of mud-laden fluid.
2. Each string of casing should be securely seated and tested to make sure that it is water-tight.
3. When cashing through a gas-bearing stratum, the space behind the cashing should be kept full of mud-laden fluid.
4. An efficient valve should be placed on top of the inner string of casing when drilling into a possible high-pressure gas sand.
5. The string of casing through which gas is taken should be seated on top of the gas sand, and the gas should be prevented from coming in contact with the wall of the hold above the sand. This precaution should be observed when gas is taken through a bradenhead as well as when a well is drilled for gas alone.
6. When oil and gas are produced from the same well, they should be separated by means of a trap and separately utilized. The Bureau of Mines is now getting out a publication describing the various types of traps in common use throughout the country, which should be ready for distribution in the near future.
7. The marketing companies should become common purchasers and prorate the production, and should purchase ratably from all producers.

In conclusion, I wish to say that what has been accomplished in Oklahoma can be applied to the gas fields of any other State, and it is hoped that the laws and regulations issued by the State of Oklahoma will be given consideration in the drafting of future laws by interested States. Gentlemen, I thank you.

DISCUSSION:

After the liberal applause greeting the conclusion of the reading of the above paper had subsided, President Cartwright said:

Dr. Manning has charge of one of the most important departments of the National Government, and it is at no small sacrifice that he has come here to address this meeting today. Although the members by their applause have already shown their appreciation I think it would only be fitting that a rising vote of thanks be extended to him, and I would also like to voice the hope that with the assistance of your Department — Dr. Manning — this Association some time — at no distant period, — will reach the point where we will absolutely cease the waste of natural gas.

Upon motion duly seconded and carried, the members evidenced their appreciation and thanks to Dr. Manning for his able paper by a rising vote.

MR. J. C. McDOWELL: Mr. President, it has been a very great pleasure to me to listen to this paper recounting the efforts of those who have been most instrumental in bringing about what I conceive to be the greatest step forward, and the accomplishment of the most important move taken by those most vitally interested in the development of the natural gas industry in America since its beginning. We, who have been in the thick of this fight in Oklahoma, are familiar with many of the important steps accomplished, having in view the conservation of this natural product. But important as the work has been, it has been done so quietly that many of you may not have become familiar with it. Therefore it is that I am particularly glad to have you all hear this paper, which is presented by Dr. Manning. A great deal of the work has been quietly done, but I want to say that what has been done by the Bureau of Mines, in conjunction with the Utilities Commission of the State of Oklahoma on this all-important subject, cannot be over-estimated. A careful working out of the conservation theory in the regulations issued by the Department of Mines, and used by the Government in its Indian leases, has been so thoroughly done that today it has become a common thing to put into the contracts that are made between the producer of gas and the producer of oil where they divide the two products, that each shall care for the interests of the other in accordance with the rules and regulations promulgated by the Bureau of Mines. No greater compliment to the efficiency of this Department or the effectiveness of these regulations and rules could be paid than this one fact, for they are universally recognized to be right.

A word as to what has already been accomplished. By the use of either the mudding-in process, or by the circulatory method of drilling, there is shut in today by this method — the result of the work done by the Bureau of Mines, and the different gas companies, in conjunction with the Utilities Commission of Oklahoma, over one billion cubic feet of gas that otherwise would have been wasted to the air — one billion — open flow — cubic feet of natural gas that would have been otherwise completely wasted.

Therefore, in view of the grand work done, and with a view of having this Association express its due appreciation of the good work done by the Bureau of Mines, and by the State Commission of the State of Oklahoma, I now desire to offer the following resolution:

Resolved, That the Natural Gas Association of America take this means of expressing and placing upon record its recognition and appreciation of the valuable work done by the Oklahoma Corporation Commission and the United States Bureau of Mines and their inspectors in promulgating and enforcing regulations restricting the waste of natural gas in the Oklahoma fields, and especially to acknowledge the effective spirit of conservation expressed in the great results already obtained, and of appreciation of the value of this accomplishment as setting forth before all other states that the natural gas resources of our country can be effectively conserved under thorough regulations and inspection.

The Natural Gas Association hereby expresses its appreciation of the work accomplished and extends its hearty congratulation and best wishes for still greater accomplishment to the Bureau of Mines and its officers and men who contributed to these results and to Commissioners Humphrey and Henshaw of the Oklahoma Corporation Commission and to their inspectors, whose joint efforts have been great and untiring in enforcing conservation.

On motion duly made and seconded, the above resolution was then unanimously adopted.

President Cartwright: The Secretary has a number of letters of regret and we will now hear from him.

Secretary Jones: Mr. President and Gentlemen: I will not take your time to read these letters, but will simply call attention to a few of the more important communications.

LETTERS OF REGRET.

Secretary Jones: Mr. President, among the letters and telegrams of regret received, I beg leave to call attention to the following:

Mr. William E. McKay, President, American Gas Institute,

Hon. Frank B. Willis, Governor of the State of Ohio,

Mr. Allison Mayfield, Chairman, Railroad Commission of Texas,

Mr. Alanson P. Lathrop, President, American Light & Traction Co., New York, N. Y.,

Mr. V. L. Elbert, General Manager, St. Joseph Gas Company,

Mr. V. A. Hays, General Auditor, Kansas Natural Gas Company, Independence, Kansas,

Mr. A. B. Macbeth, of the Southern California Gas Company, Los Angeles, California,

Mr. A. A. Lilly, Attorney General, State of West Virginia,

Mr. W. H. McKenzie, General Manager, The Wyandotte County Gas Company, Kansas City, Kansas,

Mr. E. L. Brundrett, President, Kansas City Gas Company, Kansas City, Missouri,

Mr. C. C. Cantrell, Secretary, Oklahoma Natural Gasoline Company, Sapulpa, Oklahoma,

Mr. Chas. V. Critchfield, Columbus, Ohio, and

Mr. C. W. Sears, Los Angeles, California.

President Cartwright: We will now proceed with the regular program, and the next regular order of business is a paper on the subject of group life insurance, by Mr. Lawrence C. Woods.

Mr. Lawrence C. Woods said:

Mr. President and Members of the Natural Gas Association of America:

When your distinguished Vice-President, my friend, Mr. Guffey, invited me to take part in your deliberations, I was for the moment rather non-plussed. We hear frequently in Pittsburgh of "carrying coals to New Castle," but was it complimentary or not to presume that a life insurance man could hand the artificial variety to natural gas men (laughter and applause)? However, when this steamer came sailing in here a few minutes ago on the placid waters of the Monongehela, and we no doubt felt that we were about threatened to be torpedoed, I was reminded of the story of the darkey limping into Charlottsburg, or some other place down South, one eye closed, nose all bloody, clothes all torn, and as he was trying to hold himself together, limping feebly and weakly into the presence of a friend, his friend accosted him by saying: "Why, hello, Rastus, what done happened to you?" "Well," he says, "that infernal rascal Johnsing met me out here on de road and without the slightest provocation, he sailed into me, smashed me in the eye, bloodied my nose, tore my clothes most off of me, and knocked me down." His friend said, "Why, Rastus, what done you to him?" Rastus says: "What could I done when he done and disavowed the act?" (laughter). So, I presume, after Mr. Guffey hears this talk of mine, he also will probably "disavow the act." (More laughter.)

Seriously speaking, gentlemen, I wish to say in the beginning that I do appreciate the honor and privilege of appearing before you and will try to discharge the obligation as best I may.

May I be pardoned at the outset by saying — for it is surely in order — that I do not pose as an expert, and am frankly overcome in addressing you by the conviction that most of you are perhaps more familiar with the general problems and the practical solution of the same, such as I shall present, than I could be. My few brief remarks will therefore be merely suggestive of things that most of you know. This may be worth while, as it is frequently and justly said: "We need not to be told new things so much as reminded of old ones."

I was very much interested in Dr. Manning's admirable address on the subject of the conservation of natural resources. I too am interested in the problem of conservation, but I am a great deal more interested naturally, in the problem as connected with my business, than in the conservation of natural resources, for I cannot help but feel that the most valuable resource connected with business enterprise is the conservation of human life.

I hold in my hand an extraordinary thoughtful and interesting article on "hiring and firing, its economic waste and how to avoid it," by Mr. Magnus W. Alexander of the General Electric Company. It challenges the thoughtful consideration of every employer. His researches covered twelve factories in six different states, and the astounding summation is that starting with 37,274 employes at the beginning, they wound up with 43,071 at the end of the year, a net increase in the working force of some 6,697 employes. But during this same period 42,571 people had been hired and accordingly 35,874 had dropped out of the employment. In other words about $6^1/_8$ times as many people had to be engaged during the year as constituted the permanent increase in the force at the end of that period.

Mr. Alexander calculates that 22,000 of the 42,000 engaged was entirely unnecessary and pure economic waste, and then proceeds to calculate the loss to these twelve companies at approximately one million dollars per annum.

I speak of that at the start, Gentlemen, for the purpose of illustrating to you the fact that the lengthened tenure of service of employes is a practical problem, the successful solution of which is before every employer, if he is to eliminate useless waste. That is one of the elements that the subject I am called upon to submit to you this morning directly touches. If it does not touch it then you ought not to touch group insurance. So much for one phase of this problem with reference to the need of corporations doing something along the line of this character of welfare work.

I have also in my hand a little book which I shall refer to later, and which gives a very human and very interesting story of the need of the employee. I have spoken of the need of the employer for group insurance. I shall now speak of the need of the employee for group insurance.

Lastly I have with me one of those unique and perhaps rare Magna Chartas of human liberty, where one of the Justices of the Supreme Court, Appellate Division of the State of New York, emphasizes the right, the duty and the obligation of a corporation to do for its employees what any individual would do. The learned Judge, among other things says:

"The duties of the employer to the employee have been enlarged in recent years, and are not merely that of the purchaser of the employee's time and service for money. The enlightened spirit of the age, based upon the experience of the past, has thrown upon the employer other duties, which involve a proper regard for the comfort, health, safety and well-being of the employee. A corporation may not only pay to its employee the actual wage agreed upon, but may extend to him the same humane and rational treatment which individuals practice under like circumstances. *It must do this in order to get competent and effective service.* We see corporations pensioning old and infirm employees, establishing benefits for the sick and disabled, permitting regular vacations with continuing pay, aiding in sickness, and doing many humane and praiseworthy acts which formerly might have been questioned as not fairly within the powers or duties of the corporation. *These acts are not to be defended upon the ground of gratuity or charity,* but they enter into the relation of the employer and employee, become as it were a part of the inducement for the employee to enter the employment and serve faithfully for the wage agreed upon, and become a part of the terms of employment. The considerate employer who treats his employees well is *thus able to secure better service,* and upon more satisfactory terms, than the unwilling, illiberal employer. A corporation with 13,280 employees is called upon to exercise great care in selecting and managing them so as to receive the best service. *Upon their loyalty and efficiency much of its success must depend.* The employment, training, disciplining and managing such a force, and obtaining from it the best results, is an important part of the relator's business. It is well within the corporate power to assume, as it has done, the care and treatment of such of its employees as are afflicted with tuberculosis. And unless it is shown to be wasteful of the company's money and unproductive of beneficial results, the practice may stand as well within the scope of its business. The reasonable care of its employees, according to the enlightened sentiment of the age and community, is a duty resting upon it, and the proper discharge of that duty is merely transacting the business of the corporation. If it preserves the health, the efficiency and safety of the other employees to segregate such as have tuberculosis, or are suspected of being so afflicted, the relator has the power so to do; it would seem unnecessary to discharge a trusted employee because he is so afflicted, when the company by proper treatment may again obtain the value of his services; by taking him from its offices at once it not only benefits the employee and makes his speedy recovery and return to work more probable, but protects its other employees. If we assume that the company has the legal right to care for and assume the treatment of its employees so afflicted, it must follow that it has the right to do this in the most economical and most effective manner. It would seem that to put the patient in a hospital where intelligent treatment and manner of living are prescribed by the experience of those familiar with the disease, would tend to shorten the time of his sickness, lesson the expense thereof to the company and insure his more speedy return to duty. I think the company has the right to care for and treat its employees so afflicted, and may do this in the manner which promises the best result to the patient and consequently to the company itself. The power of the company to rent premises for such treatment and care is, I think, beyond question, and if so, it is for the reason that the premises are so used for the convenient accommodation of the company in the transaction of its business. The same reasoning permits the purchase of real estate upon which the company may maintain a hospital for that purpose."

Mr. Woods then read the following paper:

GROUP LIFE INSURANCE.

Lawrence C. Woods.

Some years ago a member of President Roosevelt's cabinet assumed the presidency of one of our great life insurance companies. He found it serving a comparatively small class, largely the better paid skilled mechanics, farmers, professional and business men and women. Recently having been the Vice-President of a public service corporation — The Atchison, Topeka & Santa Fe Railroad — he thought of his new company as a public servant and soon began studying various methods by which this life insurance company could give a broader measure of service to the country as a whole. He thought it should be "people-ized" and popularized. Thoroly familiar with all phases of the problems involving labor and capital, he thought in terms of increased usefulness to employers and employes. Any institution or individual who contributed even to a small degree to the solution of these problems Paul Morton felt rendered real service to the nation, and with all the ardor of a great personality and indomitable will he sought an answer to the question — what can a great life insurance company do for employer and employe?

Having risen himself from the ranks, Paul Morton well knew that the same problems and anxieties affect the work of the laborer and mechanic as affect the banker and capitalist. Certainty, freedom from unnecessary care, tend to contentment, lengthened tenure of service and increased efficiency. The perpetual dread of the loss of the pay envelope or other income stares every man in the face, be he day laborer or corporation president. Next to life itself, nothing is more real, nothing more terrorizing to the thoughtful husband and father in any walk of life than the fear of losing his income and being unable to support those dear to him. In fact, if it be true that we love most dearly those objects for which we sacrifice most, is it not possible that the poorer that head of a family the more deep rooted may be his self-sacrificing affection for his family?

The distress consequent upon the loss of the pay envelope may strike from several angles:

I. From inability of the employer. In other words, failure of the company. Is it not permissible to say that possibly the greatest service which most employers render to their respective communities is in maintaining regular, fair pay for steady work furnished? Few people, perhaps, realize what it means in such a community as this to have regularly every two weeks years in and year out some fifteeen million dollars distributed in cash pay rolls. Self preservation is the first law of man. It is the first duty of a company to its employes, its stockholders, creditors and the general public to maintain its solvency.

II. From the disability of the employe:

(a) thro death — total, absolute, irrevocable — time and circumstance unknown quantities.

(b) thro injury or illness (1) accidents, occupational and non-occupational; (2) sickness;

(c) thro old age.

Considering these in reverse order and without minimizing the importance of any of them, it was immediately seen that:

(1) Old age cannot strike one unawares. With most of us disability due to old age seems a remote contingency. The sublime optimism of the average American leads him to feel (incorrectly as it turns out in the vast majority of cases) that he can and will make provision against this distress.

(2) Disability due to accident or illness is minimized by the fact that there is legal compensation for occupational injuries now in actual force in some thirty states. Other accidents or sickness are temporary, and many large employers of labor now tide over this period of distress by various continuations of the payroll.

(3) But death faces everyone of us daily. Loss of the pay envelope from this cause is both uncertain as to time and when it does arise is absolute and irrevocable.

That there was a very definite demand not only from employers and employes but from society as a whole that these problems should be solved and that distress arising from them should be generally provided against was evidenced by the effort of entire nations, notably Germany, to provide relief on a large scale. Great corporations in this country for many years had undertaken to solve these problems for their own employes, notable among them being the Pennsylvania Railroad, the U. S. Steel Corporation, etc., etc. Why could not a great life insurance organization with its highly specialized equipment and vast experience, be made available to corporations and other employers to assist them in meeting the most distressing of the above problems, the one calling for the earliest solution, i. e., the relief of distress arising from the loss of the pay envelope by death?

But before we proceed to explanation of the method of solution, let us again ask ourselves — is there any need of life insurance for employes? Nicholas M. Butler, President of Columbia, in his last annual report quotes a pessimistic definition of administration as "the perfect way of doing something that had better not be done at all." Let us not become enthused over a very perfect way of distributing Group Life Insurance among employes if it is not needed.

Statistics are uninteresting, as a friend of mine discovered when he reminded a young woman that he had taken her to a ball 25 years before, but sometimes they bring home some truths. Therefore, some are in order. Roughly, in this great wealthy country of America nine out of ten people leave absolutely nothing to their families except the life insurance that they carry or that is carried for them. In Allegheny County, called by Lincoln the "State of Allegheny," recent research brought out the fact that out of 30,984 deaths in six years 27,594 — 89% left absolutely nothing. And these figures have been confirmed in urban and rural districts, in New York state and city, in Toledo, Ohio, and in several rural districts. Were it not for the many forms of fraternal, industrial and ordinary life insurance, the big majority of funerals even in prosperous America would be paid for at the public expense. Later there will be mention made of an experience of one of our public service corporations pathetically corrobating the above general figures. The vital importance of relief of distress which life insurance could and would probably alone give having been thoroly established to him, an outsider and unprejudiced, Paul Morton and his associates plunged themselves into the task of forging the most useful instrument for relief purposes.

The word "insure" means "to make sure." "Safety first" in handling the problems incident to death could only be secured by a company incorporated for this purpose, having the benefit of a nation wide distribution of its risks and with a mortality experience calculated on hundreds of thousands of lives. The less the number of lives involved and the smaller the territory covered the greater the risk of calamity hazard, epidemic or other trouble, materially, if not disastrously, affecting the entire program. Furthermore, no individual employer could safely undertake such work without competent actuarial and medical advice and clerical machinery. Distributing these overhead costs over a large number of corporations would reduce them to each individual company to the minimum consistent with safety. Most companies are now operated upon the mutual plan, under which excess over actual cost is returned annually to the policyholder.

The fact that one of our great railroad corporations, a pioneer in furnishing insurance to its employes, is said to have dipped into its surplus for over $800,000 in one year to make good errors in their calculations for this and other forms of so-called welfare work indicates clearly the danger of a corporation attempting to solve this problem without proper knowledge and experience.

Exhaustive investigation over several years on the part of men experienced in actuarial problems, medical matters, finance and life insurance management in general resulted in a plan being evolved which has now been in practical use for some five years and is being utilized in its main essentials by some thousand companies, protecting to a greater or less extent the families of more than 100,000 workmen and salaried people, the vast bulk of whom have little or nothing besides.

That you may understand in its broad essentials the plan thus evolved, perhaps no better way could be taken than to tell you of the first natural gas company that we know of to have extended to its employes and their families the benefits of this interesting instrument.

More than two years ago your Vice-President, my friend, Mr. Guffey, took up thro your speaker the question of Group Life Insurance for all the employes of the Philadelphia Company. An inspection of the Group was first made. The conditions under which the employes worked, the safeguards to health and life, sanitation, environment and living conditions — in fact everything that would affect not only the life of the employes but the permanence of their employment — was considered. This is a novel substitution for the traditional personal medical examination of each life to be insured. Experience has demonstrated its practical efficiency and safety. Suffice it to say that the Philadelphia Company offered, as would most natural gas companies, a peculiarly acceptable Group risk, the employes being scattered over a wider area than many strictly manufacturing corporations, working in the open, and many of them in the country, with a tendency, therefore, toward lower mortality than the congested industrial risks.

A census of all employes was furnished, giving approximate age, annual salary, and length of service. From this was readily calculated the approximate gross cost. A blanket policy was issued as of April 1, 1914, insuring every employe between one and two years in service for half a year's pay, payable monthly during one year after death. All employes two years or more in service received full pay for one year. Each employe stated to whom the money should be paid, and was furnished with a special certificate in his own name, visualizing the insurance to him, and containing a letter from the President of the company, Judge Reed, emphasizing interest in the employe and his family and appreciation for the character of service being rendered.

By simple forms, change of pay, and therefore insurance, benefits, new employes and retiring employes are taken care of, and each month a bill is rendered for the insurance furnished.

While no individual medical examination is required of a large group already in operation, medical inspection is required and freely given for all new employes before acceptance in the Group, and is a desirable service for all concerned. It is to the interests of the employer and fellow employe that only reasonably sound and healthy people be taken in. Any other course might expose to infection or undue risk of accident others in plant or office. A great many corporations are now examining at their own expense all new employes. This part of Group Service, reasonably applied, has been found useful in many ways outside of life insurance programs.

After a year and a half's experience the Philadelphia Company still further perfected its program by adding $100 Funeral Benefit to all their Certificates, since which date the family of a deceased member of the Group receives $100, suggestive, at least, of the amount that need be paid for a modest funeral, and then twelve monthly checks.

Before passing to some examination of the principles, the actual experience of the Philadelphia Company and its allied corporations, the Pittsburgh Railways and Duquesne Light Companies, gives a picture of very great human interest. Nor do we hesitate to quote them as but strikingly corroborative of the general figures relating to dependency already given. These Groups represent a scale of pay and a class of employes above the average, and yet there have been thus far 82 deaths, insured in the Group for $58,980.78, an average of some $720 each. But 44 of these people, roughly one-half, carried any insurance, and the total was but $16,000. The average of even the half insured was only about $400, and the average personal insurance carried by the whole 82 was less than $200 apiece. Investigation further developed that the overwhelming majority of these people left dependent familites with no other resource. Is it any wonder that such a program has met with increasing appreciation as its necessity and value have become better recognized?

Group Life Insurance is wholesale insurance. Many expenses can be and are eliminated. In fact, thro annual refunds the expense is reduced to practically cost. A very satisfactory Group plan can be secured for approximately 1¼% of gross payroll. Even this is by no means extra expense. Every corporation, from dictates of heart as well as head — to sustain the esprit de corps of their employes — is continually paying for funerals and in other ways relieving distress due to the death of an employe. The advantage of Group Insurance, however, is that the employe and his family, knowing while he is yet working exactly what will be done, has a greater contentment, which tends to lengthen tenure of service. The slight additional expense required for Group Insurance gives a sound business efficiency and value to all concerned.

It is not only less expensive per thousand than ordinary insurance, but exceedingly significant is the fact that a company can do for *all* its employes what all cannot do individually for themselves. It is a well known fact that some 15% of individuals applying for personal insurance cannot be accepted. An average of 10% of the employes of any office or plant would be rejected. By accepting or declining a Group *as a whole,* every individual can be included.

In all forms of "welfare" or association work, as it is more wisely now known, the *way* a thing is done is fully as important as what is done. This fundamental thought leads to calling your attention to some apparent details. In considering Group Insurance it is prudent to keep the matter confidential. If it is found impracticable or is postponed, it is important that the employes should never know that it had been considered. It is human nature to want things that you cannot have. On the other hand, if gone ahead with, it is of the highest importance that it be not discounted in advance but announced in such a way as to grip the imagination and appreciation that alone yields value to the company. The preparation of the certificate, the presenting of it to a new employe who has completed his probationary service period, may all well enlist the thought and the time of an important officer of the company. The employe will value his certificate in proportion to the value put upon it by his company. For these reasons the attractive dress of the Individual Certificate is important. That employes and their families do appreciate their Group Insurance has been emphasized in a number of ways. A Western company found a number of their Certificates framed and hanging in the parlors of workmen's homes. If John be thinking of quitting, and Mary knows that the picture becomes valueless, is it not conceivable that John would be urged to stay on the job? Again, it has been found that certificates lost by their owners are practically as rare as a lost policy. In other words, the mass of employes, with the most meager facilities for caring for valuable papers, take better care of the certificates given to them than the ordinary man does of the policy he buys, and purposely pays for.

Lastly, one of the heads of a large company recently stated, with some apparent mortification, that in his judgment their employes preferred their life insurance certificates to stock in the company, and spoke of a recent case where the certificate, placed in the wife's hands, was the first valuable paper she had ever held.

Flexibility and adaptability thro every phase of the transaction — the winning of the good will of the employe for the company — are prime essentials. For these reasons every effort is made in the application of Group Insurance to meet the individual needs and desires of a company or its employes. While, therefore, a probationary period and the insuring of the payroll have been found desirable by most companies, the Goodrich Company, which some six months ago insured 15,000 of their employes, started with an arbitrary figure of $500 a year and $100 for each year of service up to a total of $1,000, payable, of course, monthly. They are utilizing Group Insurance, therefore, as a service award. The Pittsburgh, Harmony, Butler & New Castle Railway Company, feeling that they are able to make an extraordinary careful selection of their employes, does away with the probationary period. All these are matters for the individual consideration, necessities and wishes of each company.

During the five years that it has been in practical use Group Insurance has been subject to every kind of attack and every kind of test. It has come out of the storm like the Irishman's wall that was built 3 feet wide and 2 feet high so that, when it was blown over, it would be higher than ever. It has demonstrated its usefulness, and by many minor adjustments has been made increasingly attractive and useful to the employe and his family, and, therefore, to the employer.

Let no company or individual take up any form of "association", otherwise known as welfare, work counting upon any large measure of gratitude. Employes are no different from employers. Human nature is the same in all walks of life. Real gratitude is one of the rarest of traits and, therefore, one of the most beautiful. There is no mechanical panacea for human weaknesses and frailties. Whatever one does will be misunderstood, misinterpreted, and the consequences prove discouraging to the timid, hesitating individual. But those among employers and employes who look farthest into the future and who are most thoughtful are the ones that will appreciate this service most. Such appreciation is cumulative. As time goes on employes die, widows and orphans draw checks, benefits are visualized and brought home to all. The tendency of such a program is to lengthen tenure of service. Efficiency in our corporations is said to vary from 20 to 80%, an average of 60%. If this were raised even 5%, is not an expenditure of 1¼% of the payroll worth while? If you can grip the imagination, loyalty and appreciation of even the leading 25% of those associated with you, would you not be almost willing to forget the other 75%?

There is the negative side of the picture. Discrimination is going to be increasingly against the corporations which do not adopt what has proved to be vitally essential programs for the benefit of their employes and their families, particularly those which cannot be secured by the individual. Selection, as life insurance men call it, is going to work so that the thousands of companies which do these things for their employers, and particularly do them in the right spirit, are going to secure the services of the sons and daughters of thoughtful, farsighted parents. Young men particularly going into an avocation as a life work, will select for their employers those who for any reason serve their interests best.

We have stated that our opinion is that no corporation has a right to expend the stockholders' money except for the purpose of ultimately making more certain or larger the returns to the stockholder. The humanitarian motives which make such a program attractive ought to be kept in the background. But it is "worth while," as President Boggs of the Harmony Line has expressed it, or, to quote the New York Times "Annalist," "A man may take it upon his conscience to do more for his employes and then find that what he thought philanthropy was only very good business."

It is one of the proud boasts of America and its institutions that personal initiative has encouraged the individual to do for himself what in many foreign countries the government is obliged to do for him. The American method develops character. May we not take just pride in the fact that private initiative on the part of our great life insurance companies has successfully offered to companies an instrument by which they may voluntarily furnish to their employes what Germany, England and other countries are enforcing by drastic law? Is it not pathetically significant that the "London Times," in an interesting article some year or more ago, in discussing the development of American Group Life Insurance, remarks, "Unfortunately it has come 25 years too late for England."

To sum up the fundamental principles underlying the birth and growth of Group Life Insurance it is appropriate for me to close with the words of Judge William A. Day, President of the company which inaugurated this singularly valuable instrument for the employers and employes of America:

"Group Insurance affords opportunity for the expression of that spirit of good will and of co-operation between employer and employe without which the highest achievements are impossible. Enterprises which employ considerable numbers of people are communities in themselves, and the distress of one is the distress of all, and, conversely, the good of any one member is the good of all; therefore, whatever promotes the general welfare is worthy of approbation. By throwing around employes this blanket of protection and by putting on the Insurance Co.'s the risk and the burden which the family cannot well bear, an organization is fraternalized in a manner which will redound through higher efficiency to the good of the business and consequently the good of everyone in it. Society is realizing that those agencies which relieve and reduce shock and strain as much as is humanely possible are the fundamental factors of high value which make for stability and progress."

DISCUSSION:

After the applause following the reading of this paper had subsided, President Cartwright said:

I believe the subject of group insurance is entirely new to most of the membership of this Association, and while our time is growing rather short before adjournment, if any of the members desire to ask any questions Mr. Woods would be glad to answer them. Are there any questions?

MR. LAWRENCE G. WOODS: I might be like the gentleman who said he could answer the question by at least saying that he did not know. If any one has any questions to ask, I would be glad to try to answer them.

MR. KAY C. KRICK: If there are no questions then, Mr. President, I move that a hearty vote of thanks be extended to Mr. Woods for his very interesting and valuable paper.

Mr. Joseph F. Guffey: I take pleasure in seconding the motion.

The above motion, having been duly seconded, was then unanimously adopted.

President Cartwright: Before adjourning Mr. Holbrook would like to say a few words. He will make them brief, I know.

Mr. David O. Holbrook: Gentlemen: As the representative of the Association of Natural Gas Supply Men, I wish to ask your assistance and your help, especially in the matter of the arrangements for the beefsteak dinner. Our experience so far as this Convention is concerned has been that it is almost impossible for us to plan properly for your entertainment. We were overcrowded at the Cabaret last night and I simply want to tell you now that if you do not get your banquet tickets immediately you cannot get into the beefsteak dinner which is being arranged for tomorrow night at the William Penn Hotel at six thirty, P. M. We are not going to discommode the gentlemen who have helped us out in making our arrangements by furnishing you a dinner ticket after three o'clock tomorrow afternoon. We have so far had these tickets only on sale at the registration booth, giving the Natural Gas men the preference. If you do not care to avail yourselves of the privilege, well and good. We will put them on sale for the Supply Men tomorrow morning. Up until that time the Gas Men have had the preference, but we cannot stretch the capacity of the Hall and we do not propose to sell more than can be comfortably attended to.

At nine forty-five tomorrow morning the picture will be taken, nine forty-five tomorrow morning, and it will be taken immediately outside the Convention Hall.

With reference to the boat ride this afternoon, the boat will leave the wharf at the Exposition Building for the purpose of visiting the McKeesport plant of the National Tube Company. Lunch will be served on the boat, and the boat will return to the city about nine o'clock. The boat will leave promptly at one thirty P. M. The National Tube Company have invited all of the members of the Association to visit their McKeesport Plant, and the only identification of a member will be by his badge.

If you have already given your badge away you had better get it back if you want to go on the trip. If you are not a member of the Association and not entitled to a badge you are not included in the invitation. A lunch will be served on the boat coming back. It will be necessary for you to get your luncheon in the Machinery Hall, immediately, so that you will be ready to get on the boat which leaves promptly at one thirty. Remember please, in regard to the beefsteak dinner tickets, for without them it is impossible for you to get into the dinner on Wednesday night. That dinner we are trying to make a little better than anything we have "pulled" heretofore. I thank you.

President Cartwright: In glancing over the program I find that I have overlooked one very important order of business, and that is the "Wrinkle Department," of which Mr. W. Re. Brown is Editor, and Mr. O. K. Shannon, is Assistant Editor. We will now hear from Mr. Brown, the Editor of the "Wrinkle Department."

Mr. W. Re. Brown, Editor of the "Wrinkle Department," then said:

Mr. President and Gentlemen: I have not very much to say in presenting the "wrinkles" this year, speaking for myself, and also for Mr. Shannon, other than that we would like to thank each individual contributor to the "Wrinkle Department." Not only do we wish to thank the individual contributor to this Department, but I particularly wish to voice our appreciation to the companies, the executive officers of which have secured men in their operating departments to prepare and furnish the goodly number of wrinkles which we present to you at this meeting. These wrinkles in many instances were presented in such excellent shape that the editors simply were required to receive the copy and furnish it to the printer. Of course in other instances it has been necessary for us to perform more or less labor in shaping up these wrinkles properly. I also want to call particular attention to the portion of Mr. Cartwright's admirable address dealing with this department, and desire to thank him for the kind words to Mr. Shannon and myself.

It is my idea — and I believe Mr. Cartwright co-incided with me, that these wrinkles are gathered more particularly for the men who are actually engaged in the operating end of the business. Of course, the executives of the company are assumed "to know it all," but there are a lot of us farther down the ladder who admit that we do not know it all, and there is a whole army of operatives anxious to gain all of the available information they can with reference to all of the subject matters treated by the Department, and therefore it is my idea, and as I say, I think Mr. Cartwright co-incides with it, to prepare these wrinkles in the form of a cloth bound book and allow each company to secure a number of copies for distribution among their employees who would be particularly benefitted by this source of information. I refer particularly to the men actually doing the work. We are anxious to have these men in particular get all of the new ideas they can from this Department, and incidentally as they become familiar with the work to furnish to this Department the new ideas, and new suggestions which come to them by studying and educating themselves along these lines. There are a number of suggestions occurring to us, but I will not take your time to refer to them further now. Mr. Shannon has been working west of the Mississippi, and his work has been exceedingly valuable to the Department, and therefore, in justice to him, he having worked so hard, and succeeded so well, I wish you would allot to him a few minutes in order that he may express to you his appreciation of the assistance received from the membership of the Association. I thank you. (Applause).

PRESIDENT CARTWRIGHT: Mr. Shannon will you come forward? (Applause).

Mr. O. K. Shannon, Assistant Editor, "Wrinkle Department," then said:

Mr. President and Gentlemen: Believe me, it is some work to gather together wrinkles containing ideas and suggestions which will be of benefit in the operating and accounting departments of the natural gas business. In many ways the work has been a pleasant labor for we have had the finest "bunch" of fellows in the world to deal with, and they have given to us the best they had in the way of new thought and enthusiasm. Mr.

Brown has referred to the number of suggestions which he and I have discussed, but the only one that I desire to take the time to mention now is that I do suggest that hereafter an editor-in-chief be appointed, and I do not know a better one than Mr. Brown — and then that an Assistant Editor be appointed for each gas producing state or territory to secure and furnish to the Editor-in-Chief the various wrinkles which can be gathered together by these assistant editors throughout these various states and territories. In this way the work of the Department will be brought into closer touch with the various localities producing and using natural gas. It will localize the work. Take Mr. Brown, for example, and throughout the territory with which he is acquainted, he can write to his friend, "Dear Bill," or "Dear Tom," or "Dear Charley," and he will not have to say formally, "Dear Sir," because he knows them. He knows their peculiarities. He knows wherein he can call upon them for new ideas and new suggestions. He can "cuss" them out if they do not come across upon his request, and in this way the work in the different localities can be brought into closer touch and a marked improvement, I think, will be noted over the present method. The Editor in Chief, of course, should remain in charge over all of the Assistant Editors, but by the employment of these assistant editors, I think, as I say, the work will be localized and intensified and brought closer home and the field much more thoroughly and better covered. I think also, while grateful for what has been done, that the managers and executive heads of some of these gas companies might show just a little bit more interest in assisting us in this work, the purpose and intent of which is to benefit and help the men in their employ. In many instances we have received the most valuable assistance and co-operation from the executive heads of the larger companies, yet I am free to say in other instances I have found them "the most cheerful set of liars that ever happened." (Laughter and applause). They will write you and tell you that they are going to get all of the boys to working right away on these wrinkles, and that all we will have to do is to wait on them. Then after the lapse of a few days or a few weeks, we respectfully call their attention to the promise made and yet nothing is done. However if the suggestion we have made with reference to an assistant editor in each state or territory is put into force and effect many of the obstacles we have encountered in the past will, we hope, be more or less eliminated. Some of the managers of the larger companies, however, have used their very best endeavors to assist us in making this an important feature of our work. I recall the manager of one of the larger companies in particular. I wrote to him to send me a list of the names of the working force of his company. He immediately complied by sending me a complete list even down to the office boy. I had intended writing letters to some of them at least, but he said "O. K. if you will let me handle that matter myself I think I can save you a lot of trouble, and I believe it will produce better results." I wrote back, "Sick him, Bill." The result was I got from that one company thirteen or fourteen splendid wrinkles. They were turned in in most excellent shape. He had even permitted the Drafting Department of his Company to assist his men in preparing the wrinkles for our Department. In many instances when I got them they were "pictures of art." Mr. Brown will bear me out in the instance I have in mind. Many of the managers of the larger companies have sought to assist us in this way, and it goes without saying that we are very grateful to take this opportunity of publicly thanking each individual member who has assisted us in this way. By so assisting us you have no idea of the saving of time and expense to our Department. Personally I appreciate very much the kindness, co-operation and assistance that has been extended to us by many of the members of the Association, and I wish to express specifically my appreciation of the kindness of our President and our Secretary for the valuable help rendered by them. I thank you. (Applause).

Mr. W. Re. Brown, the Editor of the Wrinkle Department, then submitted the following:

W. Re. Brown.
Editor.

O K. Shannon.
Assistant Editor.

WRINKLE DEPARTMENT.

WRINKLE NO. 1.

DELIVERING THE GOODS.

P. D. Mellon, The Canadian Western Natural Gas Light, Heat and Power Co., Calgary, Alberta.

A 10″ high pressure gas line which delivered about two million feet of gas to a large consumer at Calgary, Alberta, was completely washed out by a severe storm, which kept the river running wild for about five weeks. A permanent line being out of the question, a 1″ cable was stretched 610 feet from towers set on each bank, and a two-inch heavy screw line pulled over on it. This line stayed in service three months, and answered its purpose until the river receded sufficient to allow a permanent line to be laid on the bottom of the river. The photograph insert shows the 2" line in service.

Wrinkle No. 1.

WRINKLE NO. 2.

WELDED PIPE SAVES TEARING UP PAVEMENT.

P. D. Mellon, Engineer, The Canadian Western Natural Gas Light, Heat and Power Co., Calgary, Alberta.

It was necessary to lay a 6" line across the street, which the city had recently paved. In order not to break the pavement, sixty-six feet of pipe was welded into a continuous tube, and jacked under the street, through an opening augered with a bit, made from three feet of pipe. 100 lb. air test was then applied, everything being tight, the pipe was connected on either side with standard couplings, and the laying continued.

This cut shows pipe being jacked across street under pavement.

Wrinkle No. 2.

WRINKLE NO. 3.

POST CARD CHECK ON LINE WALKERS.

A. J. Hubbard, Line Walker, Lone Star Gas Co.,
Alvord, Texas.

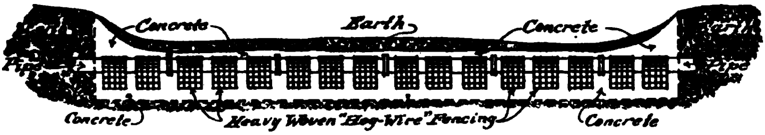
In order to check line walkers on their daily trips, have a special designed stationary punch and stamp at each end of line walker's beat. On arriving at the end of the beat, line walker will punch or stamp postal card, mailing it at that point. The cancellation stamp on the card, together with punch mark or stamp at the end of the line walker's beat check his trips.

WRINKLE NO. 4.

TO WEIGHT DOWN PLAIN END PIPE WHERE INSUFFICIENT EARTH OVER SAME.

F. W. Kirk, Main Line Foreman, Lone Star Gas Co.,
Fort Worth, Texas.

On account of washes and road grading which occur after line is laid, it is difficult at times to keep sufficient weight on "plain end" pipe lines to prevent blow out. To remedy this, have at times dug 16″ to 20″ around and below bottom of pipe and bent short sections of "hog wire" fencing over pipe; filled holes on both sides and under pipe with concrete, and wire acts as reinforcing. In this way, weight that is lacking on top of the pipe is suspended under the line. In doing this only short sections of pipe should be uncovered at one time.

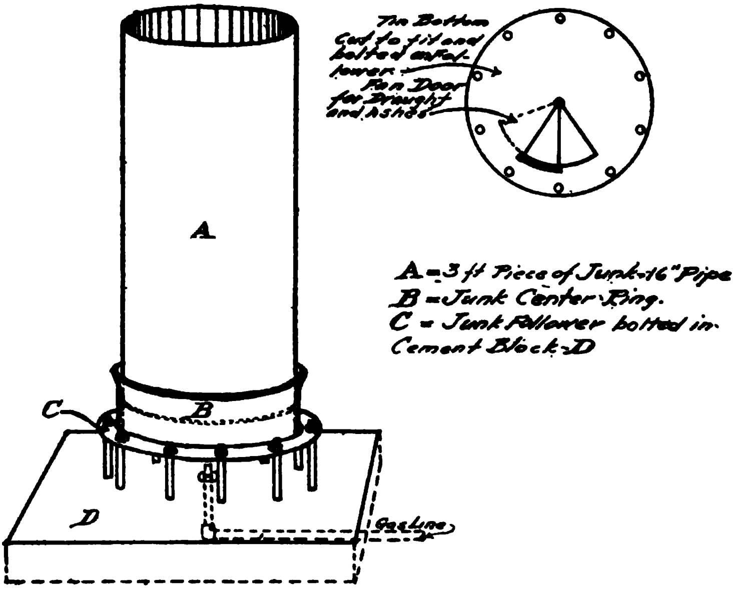


Wrinkle No. 4.

WRINKLE NO. 5.

GARBAGE BURNER — MADE OF JUNK!

Rex West, Station Operator, Lone Star Gas Co., Fort Worth, Texas.


Tin Bottom Cut to fit and bolted onto Follower
Fan Door for Draught and Ashes
A
A = 3 ft Piece of Junk 16" Pipe
B = Junk Center Ring.
C = Junk Follower bolted in Cement Block D
C
B
D
Gas Line

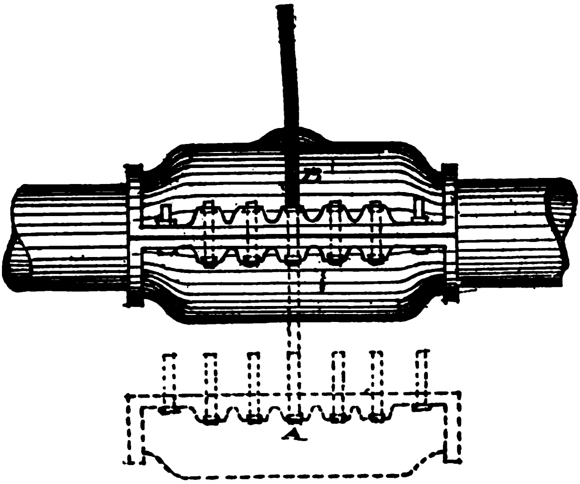
Wrinkle No. 5.

WRINKLE NO. 6.

"BOLT TO MINIMIZE LABOR NECESSARY IN PUTTING ON HEAVY SPLIT SLEEVES OVER LEAKS."

Lew Ryan, Assistant Foreman, Lone Star Gas Co., Fort Worth, Texas.

Take two ⅝" x 24" bolts, with square head and nut; 18" of thread on each bolt. Insert a bolt in center bolt hole on each side of sleeve and run down, but which gradually lifts lower half of sleeve, thereby minimizing the labor necessary in putting on sleeve and acts as a guide in seating side rubbers. After two halves of sleeve are in position, insert the regular bolts in bolt holes on each side, withdrawing the long bolts.

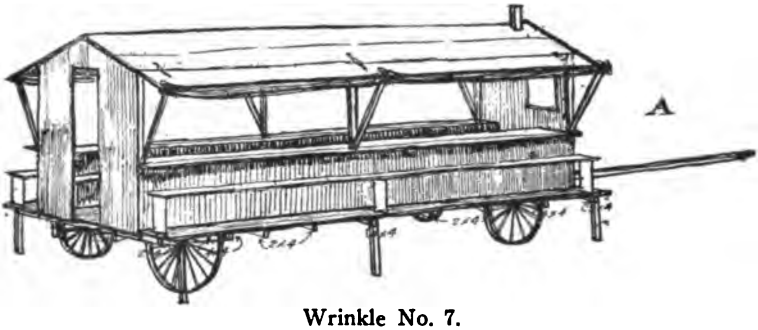


Wrinkle No. 6.

WRINKLE NO. 7.

MOUNTED COOK AND DINING-SHACK.

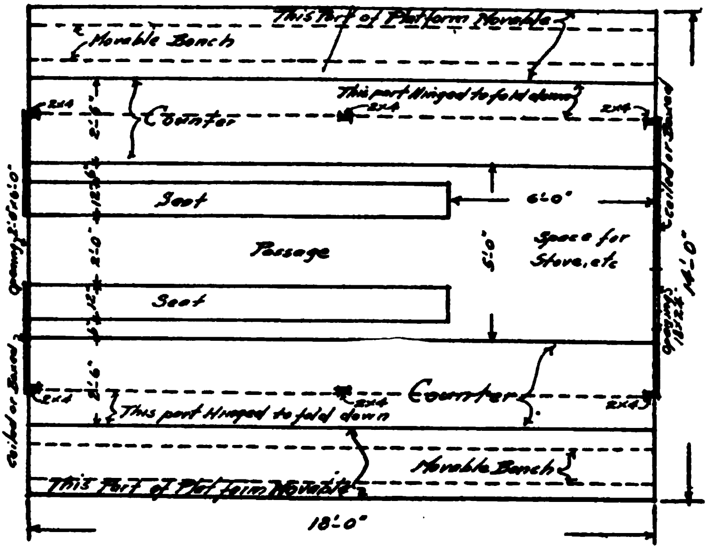
G. C. Reed, Telephone Foreman, Lone Star Gas Co.,
Bowie, Texas.



Wrinkle No. 7.

This structure is to be used on any standard, low-wheeled, wagon running gear. The house is built onto the center part of the platform. As shown on drawing "A" above, there are two 6 x 8's run lengthwise of the house, on which the house rests.

The 2 x 4's shown on "A" are simply to hold the outside platform together. The 4 x 4's shown on drawing "A" are not stationary, but slip between the house and the 6 x 8's above mentioned, and by removing these 4 x 4's the outside platform is removed. By removing this part and lowering hinged part of counters, removing props under overhang of roof, and lowering same, the whole structure is reduced to a minimum width of eight feet, making practical transportation on narrow roads. When set for use, or in bad weather, rolled canvas awnings may be lowered. Built on these lines the wagon will comfortably seat a maximum of thirty people; can be "knocked down" ready for moving in about twenty minutes. Carries all its own equipment, and on ordinary roads can easily be pulled by one team. A wagon of this type was built and has been used in telephone construction work under most severe weather and road conditions, and has proven very satisfactory in every way. Cost, including wagon running gear, about $90.00.



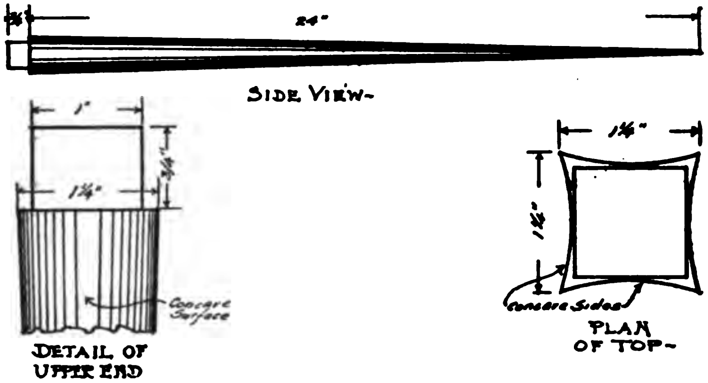
Wrinkle No. 7.

"MOUNTED COOK AND DINING-SHACK."

WRINKLE NO. 8.

"TOOL TO REMOVE BROKEN NIPPLES, ETC., FROM FITTINGS."

C. W. Rogers, Pipe Line Man, Lone Star Gas Co., Fort Worth, Texas.



Wrinkle No. 8.

Above shows four-cornered pin, two feet long, tapered from 1¼" to a point, with a square wrench seat at top; concaved sides to make it sharp and take hold of whatever is to be removed from inside of fitting. To remove broken pipe, nipples, etc., drive pin in tightly and turn with wrench. Can be used on small pipe from ¼" to 1¼".

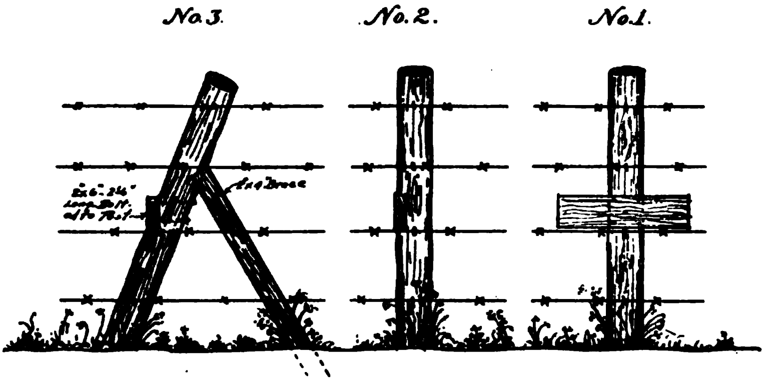
WRINKLE NO. 9.

STILE FOR USE OF LINE WALKERS IN CROSSING FENCES.

J. W. Fincher, Line Walker, Lone Star Gas Co., Bowie, Texas.

Stiles Nos. 1 and 2 above are the ones ordinarily used by line walkers in climbing over fences on their beats. Stile No. 3 is one suggested, two or three of which have been set and are giving entire satisfaction.

It is very hard and straining for a line walker to go over stile No. 1, and the cross arm will eventually work loose, thereby


No. 3.
No. 2.
No. 1.
2x6-24"
Long Bolt.
4x4 Brace

Wrinkle No. 9.

cause line walker to fall unless given a lot of maintenance attention.

In going over stile No. 2, line walker would go over right side and in the opposite direction would go over on opposite side of post, which would have a tendency to soon work stile off.

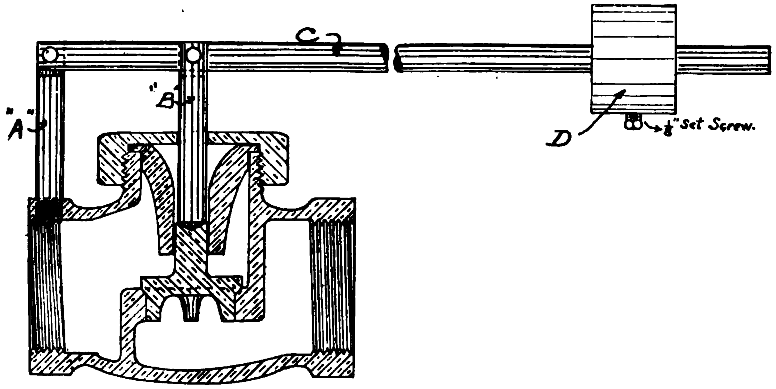
Stile No. 3 is so constructed that weight of the body is direct over the feet, and, on account of the slanting of the post, this tends to hold the cross arm secure and it is very easy and safe for line walkers to use.

WRINKLE NO. 10.

METHOD OF CONVERTING A CHECK VALVE INTO A POP OR SAFETY VALVE.

G. J. NASH, AUXILIARY ENGINEER, LONE STAR GAS CO.,
PETROLIA, TEXAS.

Above shows a simple way of converting a check valve into a pop or safety valve, easily adjustable through a small range of low pressures. Check valve shown here is a ¾". Parts "A", "B" and "C" are cut from a ¼" cold rolled rod. "A" is threaded and screwed into a tapped hole in the extreme outlet end of body of check and in line with center line of check. A clearance hole is drilled precisely in the center of the cap and the lower end of "B," which has been ground and filed to a drill point taper, is



Wrinkle No. 10.

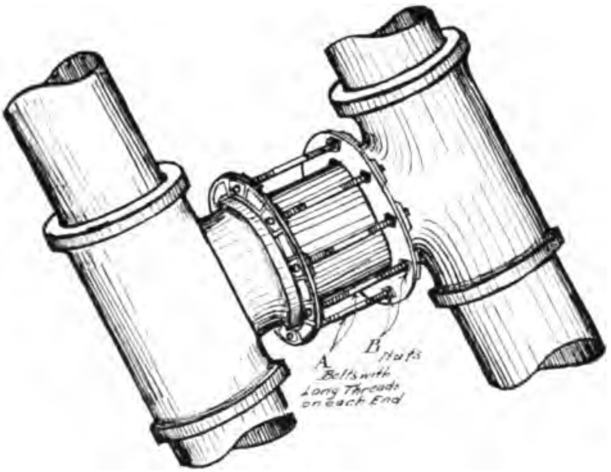
dropped through and rests in a countersunk hole or center punch mark in the stem of the "check." Rod "C" carries weight "D," which is a disc cut to any desired thickness from any desired diameter of cold rolled steel (according to pressure required) and which is set at any point on rod "C" desired, and may be fastened there with a small set screw. "C" is hinged to "A" and "B," as shown, by grinding one-half the stock of each away and drilling the ground parts and fastening with a pin or cotter key.

WRINKLE NO. 11.

TO STOP THREAD LEAKS IN REGULATOR STATIONS, CROSS-OVERS, MANIFOLDS, OR OTHER PLACES WHERE FITTINGS ARE CONNECTED BY SHORT NIPPLES NOT GIVING MUCH ROOM TO WORK IN.

G. W. Pemberton, Line Walker, Lone Star Gas Co.,
Irving, Texas.

Use ordinary collar leak clamps; place rubber over leak; reverse the followers of clamps; use bolts threaded on both ends ("A") ; run the nuts back on bolts and set in boltholes in clamps; then run nuts toward ends of bolts against followers as shown at "B", pressing the followers out against leak instead of in toward each other, as in usual case. Length of bolts to be regulated by distance between fittings.



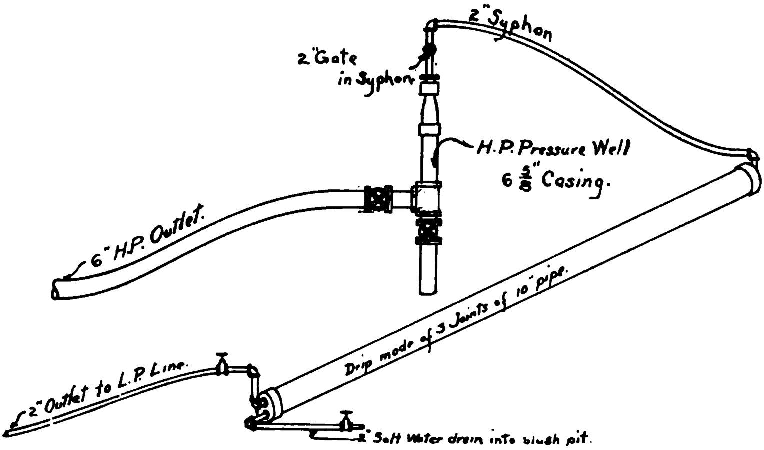
Wrinkle No. 11.

WRINKLE NO. 12.

AUTOMATIC DRIP FOR HIGH PRESSURE WELL WHICH MAKES GREAT DEAL OF SALT WATER.

J. G. REESE, FIELD FOREMAN, LONE STAR GAS CO.,
PETROLIA, TEXAS.

Above shows a very successful automatic drip in use on high pressure well, which makes a great deal of salt water. By making a 2″ low pressure connection to the low end of the drip, as shown, it is possible to regulate the drain valve so that it passes a steady stream of salt water, and all the gas which blows through the syphon is utilized through the low pressure line. It is rarely found necessary to change the drain valve and then only slightly, even when no high pressure gas is being drawn through the 6″ high pressure outlet.

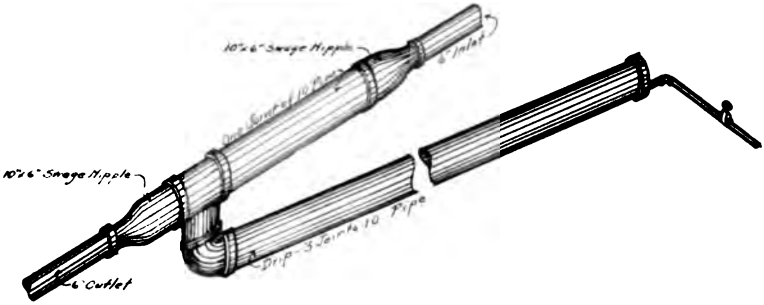

2" Syphon
2" Gate in Syphon
H.P. Pressure Well 6 5/8" Casing.
6" H.P. Outlet.
Drip made of 3 Joints of 10" pipe.
2" Outlet to L.P. Line.
2" Salt Water drain into slush pit.

Wrinkle No. 12.

WRINKLE NO. 13.

DRIP ON 6" MAIN LINE CARRYING PRESSURE UP TO 175 POUNDS.

J. G. REESE, FIELD FOREMAN, LONE STAR GAS CO.,
PETROLIA, TEXAS.



Wrinkle No. 13.

This line drip has been extremely efficient on a 6" main line carrying pressures up to 175 lbs. Owing to the somewhat exposed condition of the line ahead of this drip, which doubtless insures that the gas is down to or extremely close to the critical temperature, the slightly reduced rate of flow caused by the increase from 6" to 10" pipe, although for only one joint, seems to drop the last particle of moisture suspended. This drip shows from two to four barrels of gasoline per day, while the line at all points beyond is found to be perfectly dry.

WRINKLE NO. 14.

LOOSE LEAF RECORDS AND APPLICATION FORM.

F. C. Ingram, Supt. Commercial Dept., Southern California Gas Co., Los Angeles, Cal.

We are using for our Consumers' records a loose leaf ledger, and wish to say for the benefit of those who are opposed to this kind of a record, that we have used the loose leaf since 1908 and have never had any trouble from this source.

In 1914 we installed a double sheet to eliminate the making of transfer of accounts all at the end of the year, as was necessary with the single sheet, and at the same time it was necessary for the bookkeeper to have two books before him in order to check bills. By using two sheets there is always two years in front of bookkeeper, and transfer of meter number and other information can be made throughout the year; this, however, doubles the number of sheets in each book and it is necessary when books are large to split them for a smaller number of accounts. The extra space below the name and address is for change of names. The date the account is opened and closed appears here and no entries are made below the double line, except meter readings, consumption and money. An entry for a closed account being made in red ink and date will correspond with the date opposite name above in closed column. All cash postings are made with rubber stamp. At the end of the year one sheet is removed and placed in binders for reference, a new one for another year being inserted.

With this system our bookkeepers are able to carry 5,000 accounts, making all entries, posting cash and making all bills. We are at the present time installing a billing machine, which will save from one and one-half to two hours each day for book-

		SOUTHERN CALIFORNIA GAS CO.						
Opened		Closed	Deposit	Tested	Class	Meter No.	Set	Removed
	4-9							
	HENRY C. SUMIDA,							
	938 WALL ST.							
	C-600 E 9						Meter Book	Location of Meter
					UNPAID BILLS BROUGHT FORWARD			
		NATURE OF BUSINESS						

1915	Reading	Consumption	Amount	Date Paid	Allowance	1915	Reading	Consumption	Amount	Date Paid	Allowance
JAN.						JULY					
FEB.						AUG.					
MAR.						SEPT.					
APR.						OCT.					
MAY						NOV.					
JUNE						DEC.					

(Size: 8½ x 11 in.)

Wrinkle No. 14.

keeper; this will take care of our increase in business for sometime without increasing number of bookkeepers.

Our application is for gas and order combined. By using carbon on the upper half of order, the transaction is made in one writing, being numbered by contract clerk in triplicate at the time entry is made in contract record.

WRINKLE NO. 15.

THE FOLDER SYSTEM OF FILING ORDERS ISSUED BY THE PURCHASING DEPARTMENT.

N. L. MORSE, PURCHASING AGENT, SOUTHERN CALIFORNIA GAS CO., LOS ANGELES, CAL.

WHAT IT IS: — An individual folder having on its face a true copy of the order.

HOW TO PRODUCE: — Buy 110 lb. Buff Parchment Folding Bristol Cardboard in sheets 25½" x 30½". Have these cut into strips 14½" long by 8½" wide.

HOW TO USE: — In writing order have typist place one of these sheets of cardboard back of last sheet of your order form, inserting carbon so as to give full copy of order on the folder.

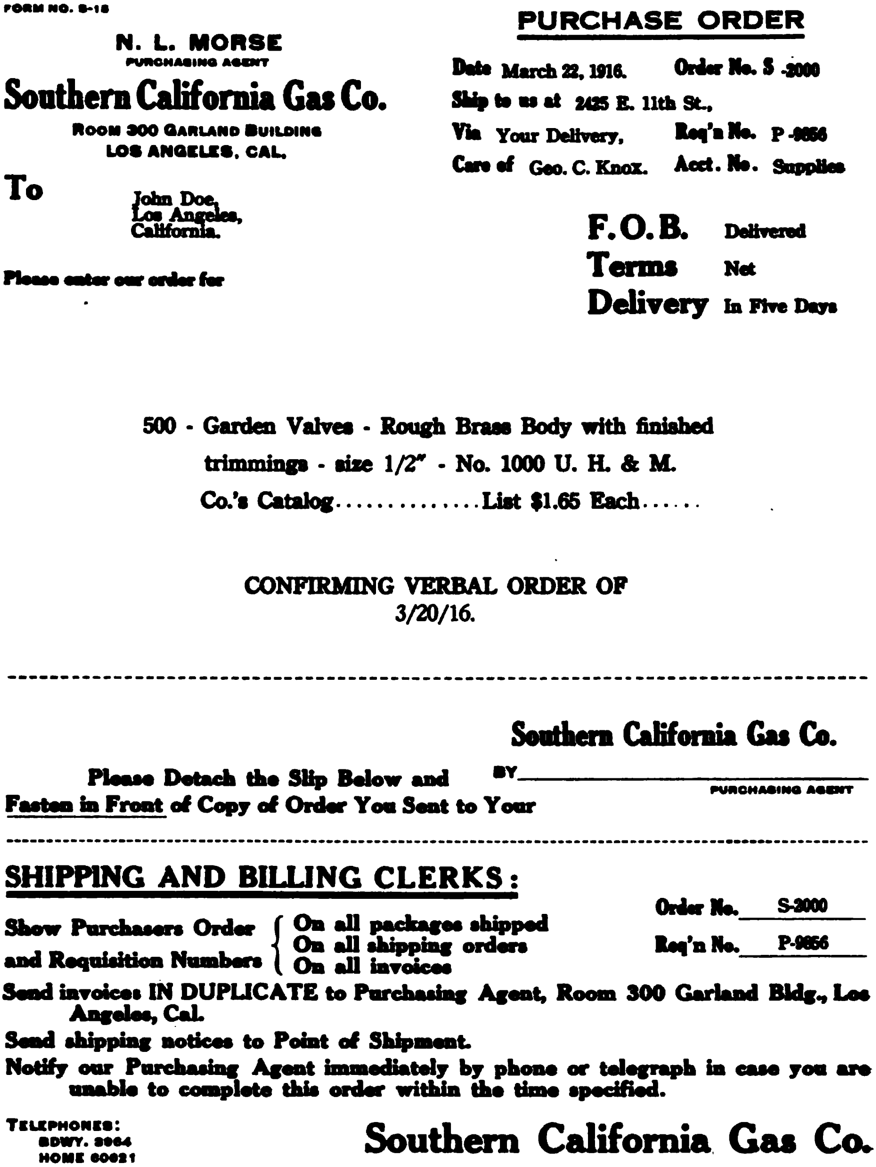
HOW TO FILE: — After folding in center, file alphabetically according to vendor's name, in Bill Size Vertical Files using Red Pressboard 80 Division Guides with Flat Metal Label Holders. This file should be known as UNFILLED ORDER FILE.

Everything pertaining to this order should now be filed in this folder, i. e., acknowledgment of order, correspondence, telegrams, duplicate Storekeeper's Material Received Report, duplicate bill, copies of freight bills, copies of claims, etc.

As a cross index, place Purchasing Agent's copy of order numerically, in Shannon Lockarch Transfer Cases.

In approving invoices, check them with copy of order on face of folder, noting thereon bill number previously assigned by Auditing Department. If order is filled complete, transfer folder to file known as FILLED ORDER FILE, which should be an exact duplicate of UNFILLED ORDER FILE.

When necessary transfer to vertical filing cases using 80



FORM NO. S-18

N. L. MORSE
PURCHASING AGENT
Southern California Gas Co.
ROOM 300 GARLAND BUILDING
LOS ANGELES, CAL.

PURCHASE ORDER

Date March 22, 1916. **Order No.** S -2000
Ship to us at 2425 E. 11th St.,
Via Your Delivery, **Req'n No.** P -9856
Care of Geo. C. Knox. **Acct. No.** Supplies

To

John Doe,
Los Angeles,
California.

F.O.B. Delivered
Terms Net
Delivery In Five Days

Please enter our order for

500 - Garden Valves - Rough Brass Body with finished trimmings - size 1/2" - No. 1000 U. H. & M. Co.'s Catalog..............List $1.65 Each......

CONFIRMING VERBAL ORDER OF
3/20/16.

Southern California Gas Co.

BY________________________
PURCHASING AGENT

Please Detach the Slip Below and Fasten in Front of Copy of Order You Sent to Your

SHIPPING AND BILLING CLERKS:

Order No. S-2000
Req'n No. P-9856

Show Purchasers Order and Requisition Numbers
- On all packages shipped
- On all shipping orders
- On all invoices

Send invoices IN DUPLICATE to Purchasing Agent, Room 300 Garland Bldg., Los Angeles, Cal.

Send shipping notices to Point of Shipment.

Notify our Purchasing Agent immediately by phone or telegraph in case you are unable to complete this order within the time specified.

TELEPHONES:
BDWY. 3964
HOME 60621

Southern California Gas Co.

(Size 8½ x 11 in.)
Wrinkle No. 15.

division manila alphabetical guides instead of red pressboard guides with metal label holders.

WHAT IT DOES:—It centralizes everything in one place. The whole transaction from the placing of the order to the receipt of the material by storekeeper, is in this folder. In other words, when one of these folders is handed the Purchasing Agent he has the entire history of the order in his hands.

This is a big advantage over other systems, particularly if the Purchasing Agent is suddenly called into a conference of executives regarding a certain order.

The order folders occupy the same relative positions in each file and as a result are quickly accessible.

WRINKLE NO. 16.

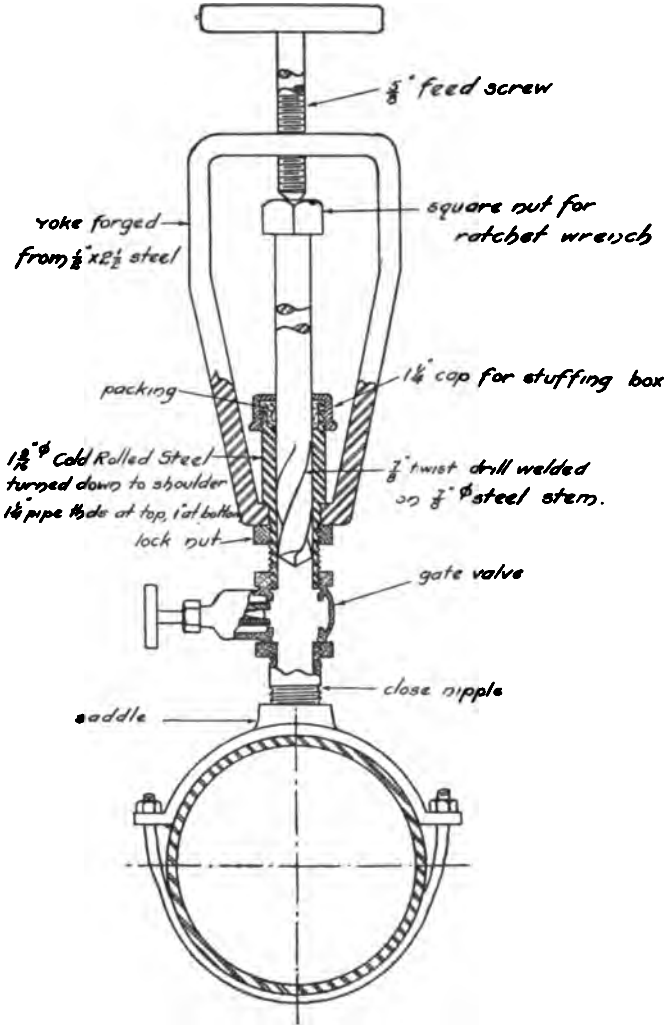
A SIMPLE KIND OF TAPPING MACHINE.

CHARLES MCMAHON, DIVISION FOREMAN, MIDWAY GAS CO.,
NEWHALL, CALIFORNIA.

The attached sketch is intended to show a simple form of tapping machine to be used for making service taps on a high pressure natural gas line. Its use is as follows:

Apply a saddle and a close nipple and gate valve on the line, then screw the tapping machine into the valve. See that the stuffing is tightened around the drill, open the valve and allow the drill to go through to the top of the pipe. Turn down the feed screw to bring pressure on top of the drill after having applied a regular ratchet coupling wrench on the square nut on the drill. By operating the ratchet wrench and using the feed screw, a hole can then be drilled through the pipe.

Upon completion of the hole, back off the feed screw, withdraw the drill so that it clears the valve, close the valve and remove the tapping machine.

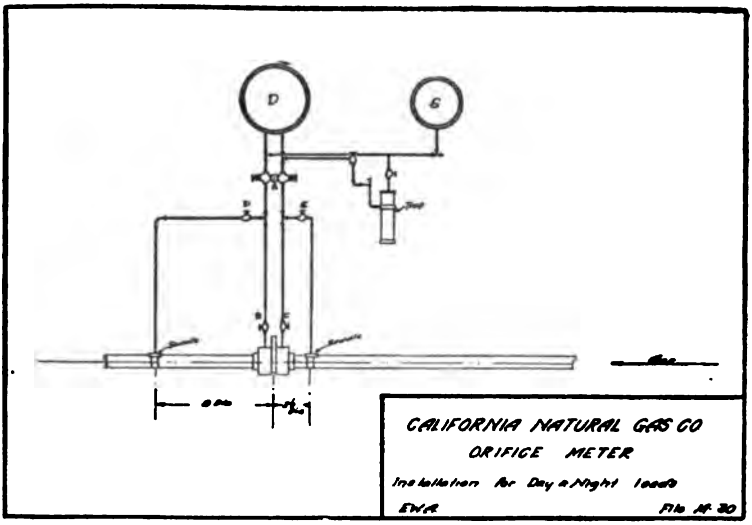

5/8" feed screw
yoke forged from 1/2"x2 1/2" steel
square nut for ratchet wrench
packing
1 1/4" cap for stuffing box
1 3/16" ϕ Cold Rolled Steel turned down to shoulder 1 1/4" pipe thds at top, 1" at bottom
7/8" twist drill welded on 7/8" ϕ steel stem.
lock nut
gate valve
close nipple
saddle

Wrinkle No. 16.

WRINKLE NO. 17.

ORIFICE METER SETTING.

E. W. Abbott, California Natural Gas Co., Taft, Cal.



Wrinkle No. 17.

Herewith I show a tracing of orifice meter setting. This has been tried out on a four-inch line, and we could not find that it interfered with the accuracy of the instrument.

WRINKLE NO. 18.

METHOD OF FLOWING DEEP WATER WELLS WITH HIGH PRESSURE GAS.

Elting Henderson, Station Supt., Midway Gas Co., Taft, Cal.

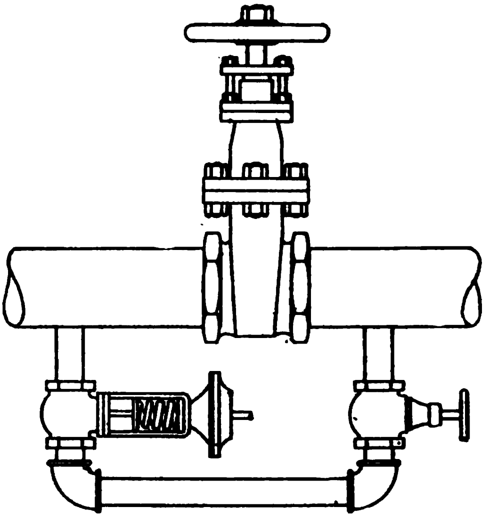
Instead of using air to flow deep water wells, as is done in the California fields, we have found it very satisfactory to use high pressure gas from our discharge lines. The well is connected up as if air were being used, and an ordinary gas separator or trap installed at the outlet, from which the water is allowed to flow into the reservoir and the gas to the fuel line of the plant or to the intake lines, if the intake pressure is low enough. A check valve should be placed in the gas line, between the fuel line and the trap, to prevent a backward flow of gas when the well is shut off. A vent through a valve to the open air should be provided on the same line and this vent should be left open until the well is regulated, when it may be closed and the gas forced into the proper line.

We have used this method against an outlet pressure on the gas line of 40 pounds, but have found the operation more satisfactory against the fuel line pressure of about 12 ounces.

WRINKLE NO. 19.

PROPORTIONAL REGULATION FOR RANGE OF LOAD.

J. T. CREIGHTON, SUPT. GAS MANUFACTURE, LOS ANGELES GAS AND ELECTRIC CO., LOS ANGELES, CAL.



Wrinkle No. 19.

The attached sketch indicates the piping arrangement we have adopted to regulate the flow of natural gas, which in our plant, is used for fuel purposes under a battery of steam boilers

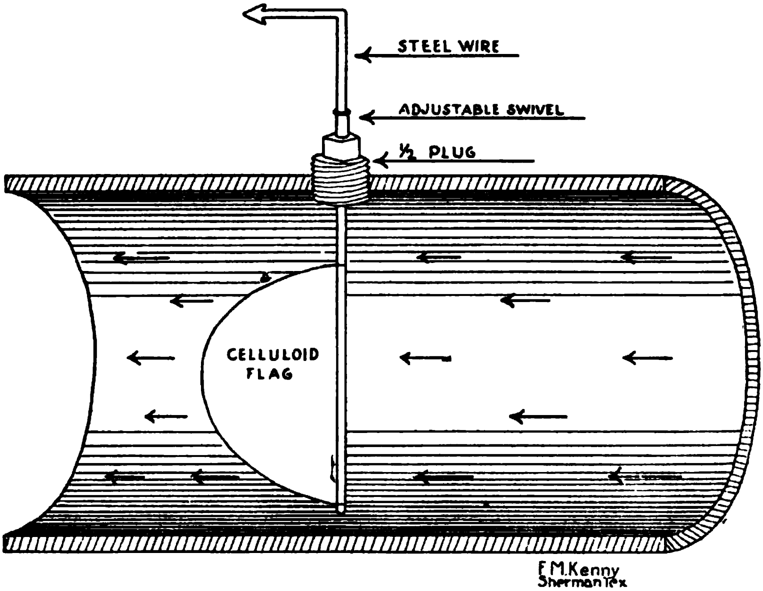
This arrangement eliminates the necessity of either individual or collective boiler regulation, which requires a single regulator for each boiler or control of all boilers with a master regulator; we used both methods with unsatisfactory results.

It will be noted that there is placed in line a two-inch regulator by-passing six-inch gate valve. This valve is set to take care of the minimum load, while the two-inch regulator handles the additional gas necessary for fluctuations.

WRINKLE NO. 20.

FLAG TO SHOW DIRECTION GAS IS FLOWING.

F. M. Kenny, Local Manager, North Texas Gas Co.,
Sherman, Texas.



Wrinkle No. 20.

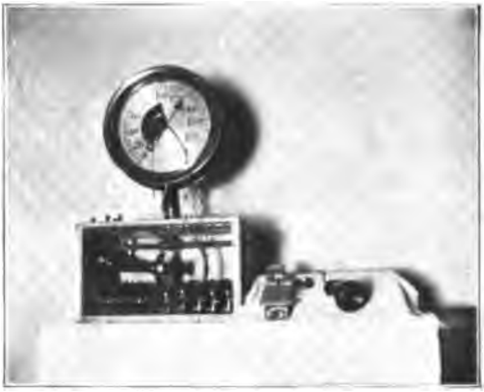
A simple device for indicating the direction in which the gas is flowing, therefore enabling one to determine which lines are supplying certain sections of the city throughout the city plant, where the lines are tied in at the different street crossings, also which city regulators are supplying the greatest area. The device is made with a ⅜" or ½" plug, a 3/32" steel wire about six or eight inches long, a very small swivel and a piece of sheet celluloid. The wire is ground flat on one side of the bottom end for about two and one-half inches so as to have a flat surface for the celluloid to be riveted to, the swivel is made adjustable so as to raise or lower the flag to the center of any size pipe that is being tested, the flag is made of sheet celluloid so as to roll around the wire while inserting, and will straighten after being placed inside the pipe. Bend about an inch of the top end of the wire to point in the same direction as the flag is pointing, then the arrow point on top end will naturally indicate the direction in which the gas is flowing. To withdraw the device, unscrew the plug and when the celluloid touches the edge of the hole begin to turn the wire around as you would a corkscrew so the celluloid will roll and it will easily withdraw.

WRINKLE NO. 21.

MUSICAL PRESSURE GAUGE.

W. H. Sedberry, Marshall Gas Co., Marshall, Texas.

Owing to various changes in volume required for a natural gas plant, especially as we sell gas to several large industrial consumers, and as our main regulating station near the city limits is about one mile from our office; in order to avoid carrying more pressure than is necessary, and to save many trips to our station, I have devised an inexpensive method of ascertaining the pressure at any time from our office by using the pressure gauge and electrical devices attached, as shown in accompanying photograph. We have secured the use of two wires from our office to the station from the Telephone Company; at the station the gauge, mounted as shown in picture, is attached to the high pressure line; in front of dial and secured to the glass front is a fibre board 1/16 inch thick with a series of small brass plates cleated to the board, nine in number, arranged on the board at a radius of about three inches from center of dial. To form contact with the hand of gauge when current is turned on by the push button at office causing a wire lever connected to a magnet (telegraph sounder) within the box to form a contact, there are nine electric call bells, with bells removed, placed on a wooden base at bottom of box, and these are arranged in a row so as each clapper will ring a different note on the toy xylophone placed in front of the bells and secured to the same base; each note represents a certain zone of pressure, the lowest note of the scale denoting a pressure of 10 or less pounds, the next 10 to 15, 15 to 20, 20 to 25, 25 to 35, to 45, to 55, to 65, to 75 and above.



Wrinkle No. 21.

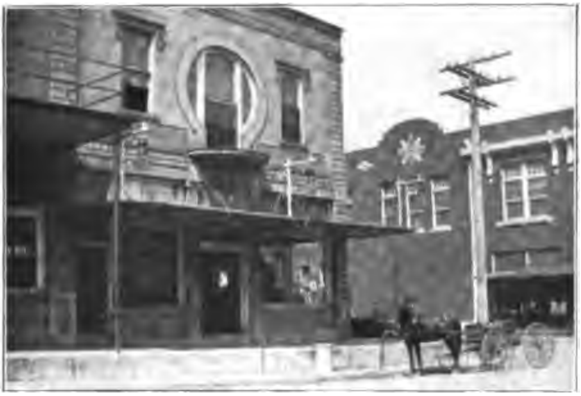
The brass plates over dial are connected by nine small insulated wires to a series of binding posts on top of box, and these posts are also connected to the nine electric bells (bells taken off and hammers ring the notes on xylophone); a telephone transmitter is placed in the box, completing the arrangement for the station end. At the office we have a duplicate xylophone with the corresponding pressure marked on each note, a push button and a telephone receiver as shown at right of picture; in order to operate, we use two currents, metallic (2 wires) with push button to form contact for bells, and one wire and ground for phone circuit. To tell approximate pressure at station, we simply place receiver to the ear, push button, locate proper tone on xylophone, and there you have it.

WRINKLE NO. 22.

OUTSIDE ILLUMINATION.

W. H. SEDBERRY, MARSHALL GAS CO., MARSHALL, TEXAS.

Having a flat awning in front of our office, the awning being rather low, we wished to make an attractive display of gas arcs, and concluded to mount them as shown in accompanying photograph.



Wrinkle No. 22.

The supports are made of 2-inch pipe and railing fittings braced with graceful metal scrolls and secured to top of awning with screw flanges; ½-inch pipe is fitted inside of supports and all of the three lamps are controlled from within the office by one shut-off valve; gas is supplied to the pilots through hollow wires connected to an independent gas pipe.

The task of making these supports, changing the pilots to independent connections and mounting the installation was done by our Mr. W. C. Allen.

WRINKLE NO. 23.

USE ASBESTOS WICKING SOAKED IN OIL.

A. C. Rogers Gas Co., Gainesville, Texas.

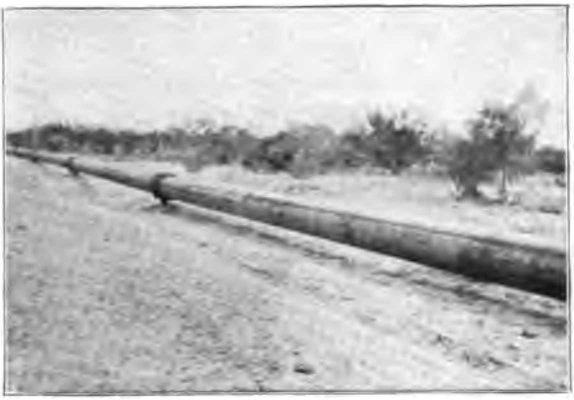
Try this plan for a gasket that will hold when experiencing difficulty in keeping an ordinary split sleeve from blowing out on high pressure lines. Also, this is good under saddles and various other places. Make a three-plait of asbestos wicking the length of the gasket required and soak in oil before using.

WRINKLE NO. 24.

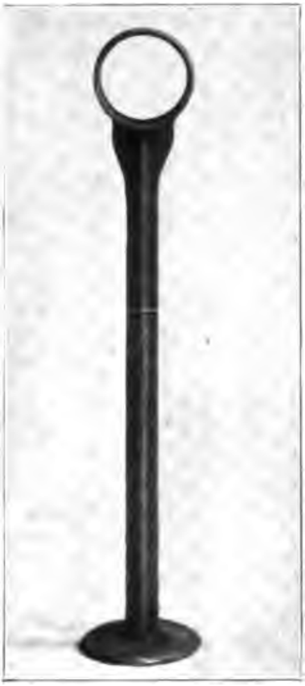
SUPPORTING PIPE LINE ABOVE GROUND.

M. R. Cullinan, Border Gas Co., Laredo, Texas.

I am sending photographs showing the couplings and supports used on our line. This coupling was designed by Mr. J. H. Howard for the purpose of supporting the pipe above ground because the ground was very salty and the moisture caused by sweating, or during wet periods, destroyed the pipe very rapidly. Paint was of very little service in protecting this pipe.



Wrinkle No. 24.



Wrinkle No. 24.

These couplings and supports have now been in about a year and have stood the test of winter and summer without giving us the least trouble. The cost of the coupling and support is not great, it being cast, as you will note, in one piece.

You will note that the pipe does not touch the ground at any point except where earth is piled over the joint to lessen the tendency to contract and expand. Where such dirt is placed, the pipe is thoroughly coated with a good asphalt paint, and our plan is to remove this dirt, say once in three or four years, or as often as necessary, when the pipe will be again painted and covered up as before.

Ditching, where these couplings are used, is unnecessary, of course. The holes for the couplings and supports are made with an ordinary post hole digger and are so arranged as to make the pipe line even on the surface.

Where the pipe is liable to more strain, or where water is liable to come against it with great force, we slip over one or more extra couplings and supports, placing them in such manner as to brace the line against any unusual external pressure from the side.

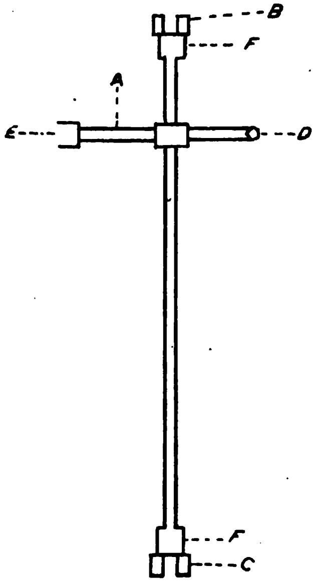
The same coupling that we use would be adaptable to screw pipe, to be slipped over the threads as the pipe is being laid, placing it where it might be necessary to furnish the greatest support. This, of course, is only adaptable to conditions as found in this part of the country; where there are few cultivated fields, or where, for any reason, it is necessary to keep pipe above the ground.

These couplings are made in different lengths and average about forty pounds in weight.

WRINKLE NO. 25.

COMBINATION STREET KEY.

M. G. MITCHEL, FORT WORTH GAS CO., FORT WORTH, TEXAS.



Wrinkle No. 25.

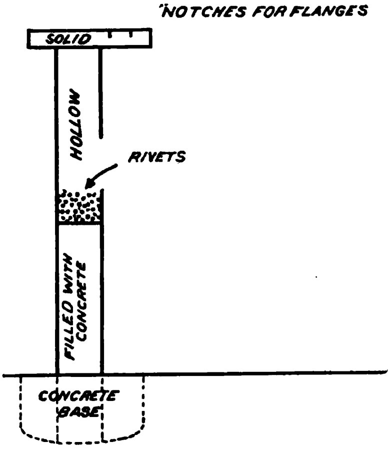
This key has connections for different sized stops and opener for different makes of boxes all combined in the one tool. The handle is fitted with the box keys and slides from end to end making possible the use of the different stop keys and always having handle on top. (A) Sliding handle. (B) Key for 1″ and 1¼″ stop. (C) Key for 2″ stop. (D) Key for Buffalo stop box. (E) Key for Hayes' stop box. (F) Square places to receive sliding handle.

WRINKLE NO. 26.

A RIVETING POST.

J. R. GILBERT, FORT WORTH GAS CO., FORT WORTH, TEXAS.

The drawing shows a post used to rivet on riveting tube screws. Made from an old lamp post (iron) with flat piece on end. Post is sunk in concrete and filled inside with same to about half way. Hole is cut in side of hollow part of post and cavity used to hold rivets. Flat piece on top is notched to receive meter flanges.



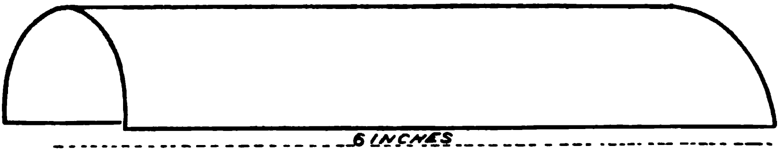
Wrinkle No. 26.

WRINKLE NO. 27.

TIN SIDE TUBE.

J. R. Gilbert, Fort Worth Gas Co., Fort Worth, Texas.

Short tin side tube for tin meter used in connection with new type riveted tube screw.



Wrinkle No. 27.

This tube is used by the Fort Worth Gas Co., Fort Worth, Texas, and is known as the "Texas Special." It is especially applicable in natural gas — there being no condensation to contend with — eliminates sources of leaks, and is less costly.

WRINKLE NO. 28.

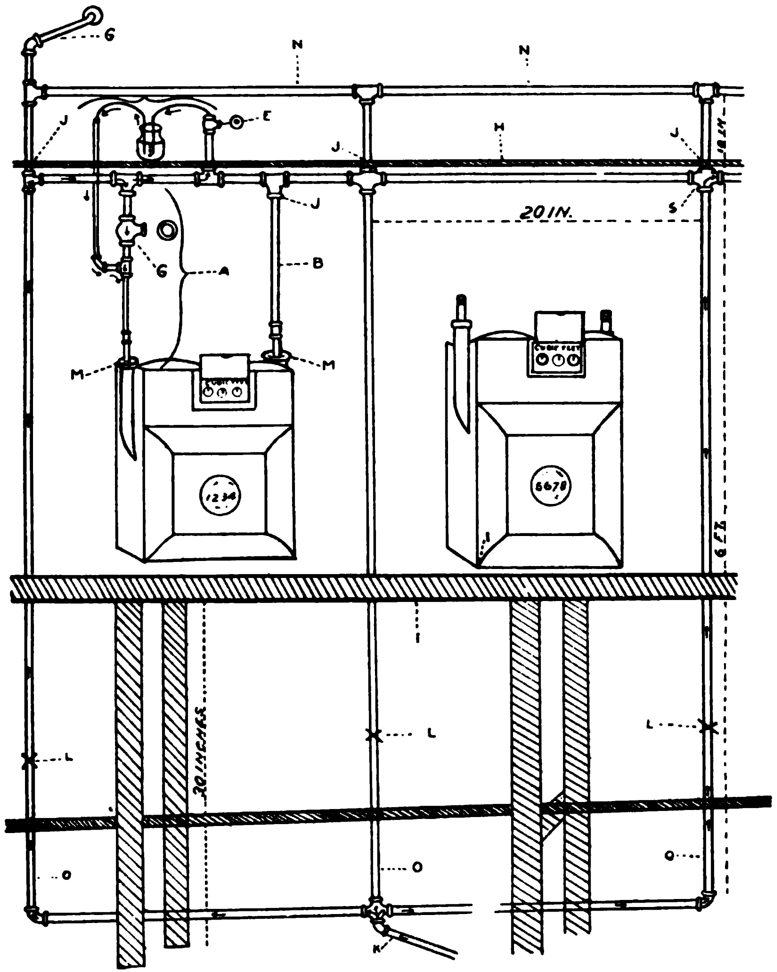
A MACHINE FOR TESTING METERS FOR LEAKS.

J. R. Gilbert, Fort Worth Gas Co., Fort Worth, Texas.

The pressure is furnished by an old prover, which has the bell weighted down until a pressure of one pound is secured. This pressure is sent to the machine proper through the line (K) and follows one of the main stems (O), following the arrows through the main valve into the meter. The main valve is then shut off and valve leading to bottle opened and any leak on meter will draw pressure through by-pass and show bubble in bottle.

One inch pipe is used for the machine proper with reductions for meter brasses. The by-pass is run from the tees facing backward and the connection to the bottle is made from hollow wire leading from ¼-inch pipe.

The sliding connection is dead-ended and is merely an extra support for the meter. It slides from tee to cross and accommodates different sized meters.



Wrinkle No. 28.

A — Main meter connection. (Solid made up.)
B — Sliding connection. Made so in order to handle meters of different widths. Made by using large tee sliding on frame.
C — Main valve — controls pressure to meter.
D — By-pass
E — Valve controlling by-pass.
F — Bottle of water.
G — Brace fastening machine to wall.
H — Shelf holding bottles for by-passes.
I — Bench for holding meters.
J — Shows dead ends.
K — Line leading from source of pressure.
L — Meter cocks used to shut off pressure on individual units in case of break.
M — Meter brasses.
N — Brace for top of machine.
O — Main stem.
Arrows show course of pressure.

The machine passes through the center of the bench and shelf, thereby securing stability and is also braced to wall.

As many sections can be made as desired and combined in the one machine. Each section is dead-ended at (J) and controlled by stop (L), thus being independent of each other.

Properly constructed, this machine is infallible.

Now in use in meter shop of Fort Worth Gas Co., Forth Worth, Texas.

WRINKLE NO. 29.

METER BENCH AND SOME OF THE WRINKLES USED AT FORT WORTH, TEXAS.

J. R. GILBERT, FORT WORTH GAS CO., FORT WORTH, TEXAS.

The bench we use for tearing up meters has the top slatted allowing condensation to run into drawer beneath the bench. This drawer is slanted and lined with tin and a pipe from the bottom of drawer drains condensation into a bucket.

The bench tools are all set in lead foundations in a box under top of bench. This makes the tools solid.

Beneath the bench we also have a galvanized iron tank filled with water, which we use as an aid in finding leaks in meters. This tank is covered by the bench top, a section of which is on hinges so that it may be raised. When not in use the whole top of bench can be used. For testing, the meter is connected to gas hose and lowered into tank.

We use a stand for working of diaphram meters. This consists of two pieces of board and two nipples — one larger than the other. Nipples extend through the wood and are held by small piece of metal sawed from a collar and act as a lock nut. This lock nut is countersunk into the wood.

We also use an iron acid cup made of short 2″ nipple and 2″ cap. This cannot break or tilt over and spill contents, also the metal will remove any energy acid may retain after being cut.

Another handy contrivance is a box for holding Tobey change wheels. This consists of thick wire run through the bottom of box and bent over. A second board is nailed on the bottom to hold the wires solid. In this box is also a compartment to hold small Tobey parts.

The funnel used for oiling diaphrams is an oblong tin box. This lays flat on meter in space each side of side pipes. It has a capacity of one quart.

We take the ordinary pipe pliers and grind out the inside for use on stuffing boxes of meters. With this tool center box can be worked without removing worm tangent or bridge.

Our rack for oiling diaphragms is cut with notches for side pipes. This allows meters to lie flat and oil to cover further on leather; this rack is made of 2" x 4" lumber.

The funnel we use for changing water in prover has a pipe long enough to reach to the bottom of the prover, thus allowing hot water to circulate all through the body of water and make temperature nearly uniform.

WRINKLE NO. 30.

REPORT FORMS.

L. R. Whitehead, South Western Gas & Electric Co.,
Texarkana, Tex.-Ark.

The cuts herewith show three Forms that I have used very successfully in my department:

A Monthly Report on large Station Meters that deliver gas to the city.

A Daily Report of all work in the Gas Department, to be made out by the Superintendent and Station Head, to the Manager, thereby keeping the Manager in close touch with the business.

A Daily Report of the Motor Driven Vehicles and what work has been done by each car.

Trusting these will be of service to your department and help some fellow out of trouble.

Form 90

SOUTHWESTERN GAS & ELECTRIC COMPANY

TEXARKANA DIVISION

DAILY VEHICLE REPORT

DATE

METER SET ORDERS

METER REMOVE ORDERS

METER CHANGES

COMPLAINTS

TROUBLE WORK

MILEAGE

REMARKS: Include Condition of Vehicle

Vehicle No......................... **Signed**..

(Size: 5⅝ x 8⅜.)

Wrinkle No. 30.

DAILY STATEMENT OF GAS DELIVERED TO TEXARKANA

S. W. G. & E. CO.

	NORTH METER					SOUTH METER					
Date	Gas Passed Gross	In Pressure	Out Pressure	Multp.	Gas Passed Net	Gas Passed Gross	In Pressure	Out Pressure	Multp.	Gas Passed Net	Total Gas Passed Net
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
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20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											
Total											

Form 42 (Size: 8½ x 11 in.) (FRONT)

Wrinkle No. 30.

(BACK)

Date	Max.	Min.	12 N.	3 A. M.	6 A. M.	9 A. M.	12 M.	3 P. M.	6 P. M.	9 P. M.	Estimated Delivery South of H. P. Station	Total Gas Delivered	Gas Metered to Consumers	Gas Unaccounted For	Per Cent. Total
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
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25															
26															
27															
28															
29															
30															
31															

Form 42

Wrinkle No. 30.

(TEXARKANA DIVISION)

METERS

	No. 1	No. 2	No. 3	No. 4	5 LT	10 LT	20 LT	P. P.	Prop.	Old	New	Daily Total	Monthly Total
Set Tex.													
Set Ark.													
Removed Tex.													
Removed Ark.													
Moved Tex. to Ark.													
Moved Ark. to Tex.													
Moved in Tex.													
Moved in Ark.													
Changed Set													
Tex. Removed													
Changed Set													
Ark. Removed													

SERVICE

New Services Run Tex. ( ) Ark. ( ) Cum. ( )
New Services Replacing Old Tex. ( ) Ark. ( ) Cum. ( )
Old Services Discontinued and Cut Off Tex. ( ) Ark. ( ) Cum. ( )
Services Fitted with Cock and Box Tex. ( ) Ark. ( ) Cum. ( )

MAINS

No. Feet New Main Laid Location Same
Notes
Total Feet for Month Tex. Ark.
Old Mains Repaired

Max. Temp. Weather
Min. Temp. Max. Del. Per. Hr. HP Meters
Mean Temp.

MISCELLANEOUS WORK

Correct as above.

Supt. Gas Department.

(Size: 8½ x 11 in.)

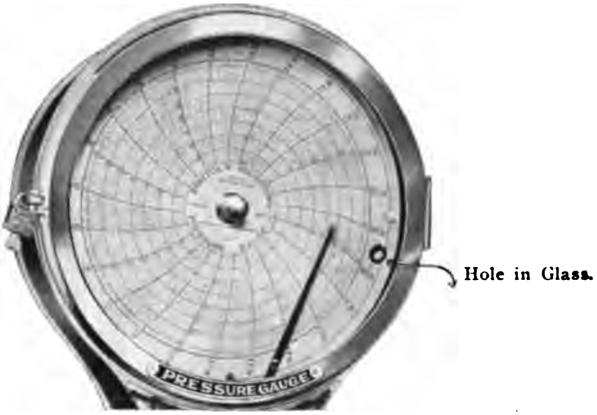
Wrinkle No. 30.

WRINKLE NO. 31.

THIS RECORDING GAUGE IS ALSO A TIME CLOCK.

C. E. DODDS, GENERAL MANAGER, CITIZENS LIGHT, HEAT AND POWER CO., LAWRENCE, KANSAS.

In order to check our night man's attention to the pressure, we drilled a hole about ⅜" in diameter in the glass of our Bristol recording gauge just over the margin of the chart, and then set the hole directly on a line with the pen, so that a mark made on the chart through the hole would coincide in time record with the record made by the pen. Then we mounted small rubber stamp on the end of a round stick which would just go through the hole in the glass, and locking the door of the gauge so that it would be impossible to tamper with the record, required the night man to register on the chart each time that he examined it. We find that it is impossible for a man to register without seeing the pressure record, and if anything unusual has happened, he will be certain to note it.



Wrinkle No. 31.

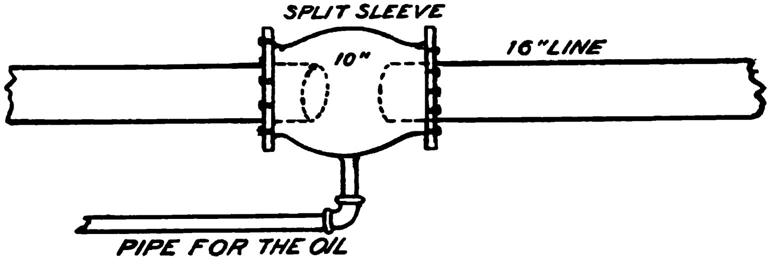
For years we kept a regular night man on duty, and occasionally had trouble with his failing to keep track of the gauge and the variations in pressure. About a year ago we made an arrangement with a merchant's watchman to call at our office and register on the gauge about once an hour, and the new method has worked exceedingly well, besides making a big saving in wages. As the register can be read to within fifteen minutes, we have a positive record of how often the man was there and when, and in case anything goes wrong he can call some of the company people on the 'phone, which is about all a night man could do.

WRINKLE NO. 32.

A DRIP PIPE FOR OIL.

F. J. Coyle, Kansas City Natural Gas Co., Kansas City, Mo.

Mr. W. J. Hinchey suggested that I send you a description of a drip for oil that I installed at Ottawa on our K. C. 16″ line. If you can use it I am glad to help.



Wrinkle No. 32.

Oil in a gas line clings to the sides of the pipe and drifts along passing a Tee, and goes with the gas up over a standing drip. To stop the oil in this line I cut out a 16″ coupling leaving 10 inches of space between the ends of the pipe, put on a 16″ Dresser Split Sleeve and the 3″ opening looking down and made the regular drip connections to this opening, as per sketch.

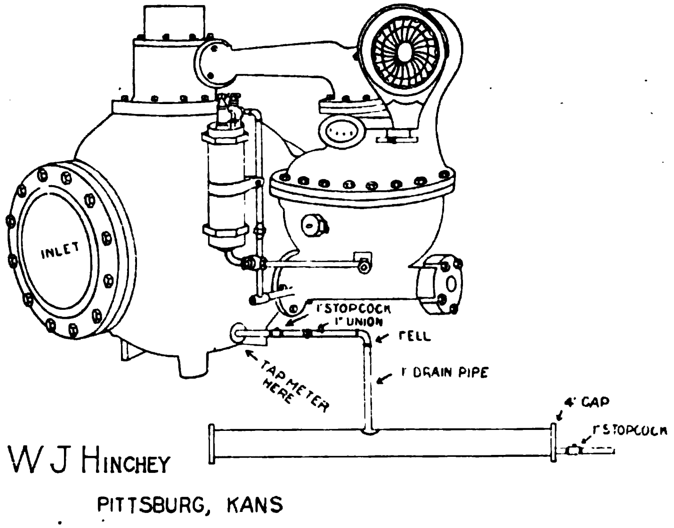
This drip has been in use for six months and gets the oil.

WRINKLE NO. 33.

DRIP FOR FIELD OR STATION METERS.

W. J. Hinchey, Kansas Gas and Electric Co., Pittsburg, Kansas.

The attached cut shows drip to be used on field and station meters. As you know some water gets by our well drips and into our meters. We have found it necessary to put a drip on our meters.



Wrinkle No. 33.

Enclosed find print which is explanatory for itself. This drip can be used below the frost line if necessary and use an extension key to blow same off.

I have connected it to a Westinghouse meter but same can be used on any proportional meter.

WRINKLE NO. 34.

A COMPLETE METER CHECK CARD.

J. W. BECKER, MANAGER, OTTAWA GAS & ELECTRIC CO.,
OTTAWA, KANSAS.

The card shown herewith is one Mr. W. J. Hinchey has asked me to send you together with a brief explanation of its use.

The card is one which was gotten up by the writer and which we find most satisfactory in use in our meter testing department. It is practically self explanatory — it has six spaces to be used in case of complete overhauling of the meter and nine spaces to be used when neither repairs or adjustment are required, which is often the case. The card therefore lasts one might say indefinitely and yet keeps all the data and information pertaining to the meter together and on the same card. The last two numbers of the meter are the index guide, the cards being filed in a cabinet in numerical order from 1 to 100 inclusive (using an index *guide card* for each number); for example, all meters, the last two numbers of which end with 25, are found with index guide card 25. It being easy to turn to the card without delay in all cases. We have a meter number, say 256398, it will be found filed with index card 98. The record on the card is filled in direct by the meter repair men, thus saving the time of recopying and the chance of error in so doing. The cards are then turned into the office where they are looked over before being returned to the cabinet for filing. We use a punch on the margin of the card punching the year showing when the meter is again due to be tested. Should it come in before this time, which is frequently the case, the space for miscellaneous test on the card is used, in the event the meter is found correct and tests out O. K. We also have these printed on different colored cards using a certain color for a certain make meter; this makes it a little easier to find the meter wanted in cases where various make meters are in use.

1920 1921 1922 1923 1924 1925 1926 1927 1928 1929

When Received ....

Kind.................................Size.........................Mfg. No.................................

First Test—Open............%............Check............%............State....................

Corrected—Open ....%............Check............%............State....................

Repairs Made..

....

Date..................................Repaired by.......................Tested by.......................

REMARKS ....

First Test—Open............%............Check............%............State....................

Corrected—Open ....%............Check............%............State....................

Repairs Made..

....

Date..................................Repaired by.......................Tested by.......................

REMARKS ....

Miscellaneous Tests where neither repairs or adjustment were required

Date	Open	Check	State	By
....	........%........	........%........	....	....
....	........%........	........%........	....	....
....	........%........	........%........	....	....
....	........%........	........%........	....	....
....	........%........	........%........	....	....
....	........%........	........%........	....	....
....	........%........	........%........	....	....
....	........%........	........%........	....	....
....	........%........	........%........	....	....

1930 1931 1932 1933 1934

1935 1936 1937 1938 1939 1940 1941 1942 1943 1944

(FRONT)

Wrinkle No. 34.

First Test—Open............%............Check............%............State......................

Corrected—Open ....%............Check............%............State......................

Repairs Made...

....

Date..................................Repaired by.........................Tested by......................

Remarks ....

First Test—Open............%............Check............%............State......................

Corrected—Open ....%............Check............%............State......................

Repairs Made...

....

Date..................................Repaired by.........................Tested by......................

Remarks ....

First Test—Open............%............Check............%............State......................

Corrected—Open ....%............Check............%............State......................

Repairs Made...

....

Date..................................Repaired by.........................Tested by......................

Remarks ....

First Test—Open............%............Check............%............State......................

Corrected—Open ....%............Check............%............State......................

Repairs Made...

....

Date..................................Repaired by.........................Tested by......................

Remarks ....

(BACK) Wrinkle No. 34.

WRINKLE NO. 35.

AN EASY VALVE CLEANER.

JOHN H. JONES, METER REPAIRER, PARSONS NATURAL GAS CO., PARSONS, KANSAS.

Get a piece of cast iron 1¾" x 1⅝" x 1½" thick, machined on one side perfectly true; cut a piece of emery cloth the size of plate and large enough to work up on side of same; make a band out of copper or tin to hold cloth on the plate. I shellacked a wooden handle on to plate. ;

WRINKLE NO. 36.

A POWERFUL SCREW-DRIVER.

JOHN H. JONES, METER REPAIRER, PARSONS NATURAL GAS CO., PARSONS, KANSAS.

Get a short, heavy screw-driver, with the blade extending through handle, drill a 3/16" hole through handle about 1½ inches from top of handle, and drive a piece of steel or iron through hole making a "T" shaped handle of same. I used a flag wire from a 5-Light meter for mine. This screw-driver does away with wrist cramp, usually caused by a straight-handled screw-driver, when used on tight screws.

WRINKLE NO. 37.

A CLAMP FOR HOLDING MIDDLE CRANK OF TOBEY METER.

JOHN H. JONES, METER REPAIRER, PARSONS NATURAL GAS CO., PARSONS, KANSAS.

If found necessary to shift lower crank to bring meter together on open and closed test, take a piece of thin strap iron long enough after bent in "U" shape to reach over bottom part of crank down and clamp over middle crank. To make it more rigid take a piece of spring brass wire, about No. 8, and bend same over and around top and clamp, thus making it like a vise.

WRINKLE NO. 38.

CONVERTING PREPAYMENT METER INTO STRAIGHT METER.

JOHN H. JONES, METER REPAIRER, PARSONS NATURAL GAS CO.,
PARSONS, KANSAS.

A quick and easy way of converting a prepayment tin gas meter into a straight meter without the work of taking out all prepayment attachments, is to take off the money box, then money cylinder from gear box, cut piece of tin to fit in gear box where cylinder came off and solder it there. Then cut piece of tin and solder it over glass in credit box. Take off top of meter, take out pinion axle, open prepay valve wide open, and you have a straight meter ready for other repairs and the prover. I have changed hundreds of meters in this manner.

WRINKLE NO. 39.

AN ATTACHMENT FOR PIPE THREADING MACHINE.

W. E. NESTOR, CHIEF ENGINEER, CADDO DIVISION, SOUTHWESTERN GAS & ELECTRIC CO., MOORINGSPORT, LA.

The accompanying drawing shows an attachment for driving Toledo pipe threading machines with air motor or other means which the writer designed last summer.

As we had considerable 6″ and 8″ pipe to thread while installing some new compressors at one of our stations, and being located some distance from a machine shop, we found this device to be a very valuable adjunct, both from a labor and time saving standpoint.

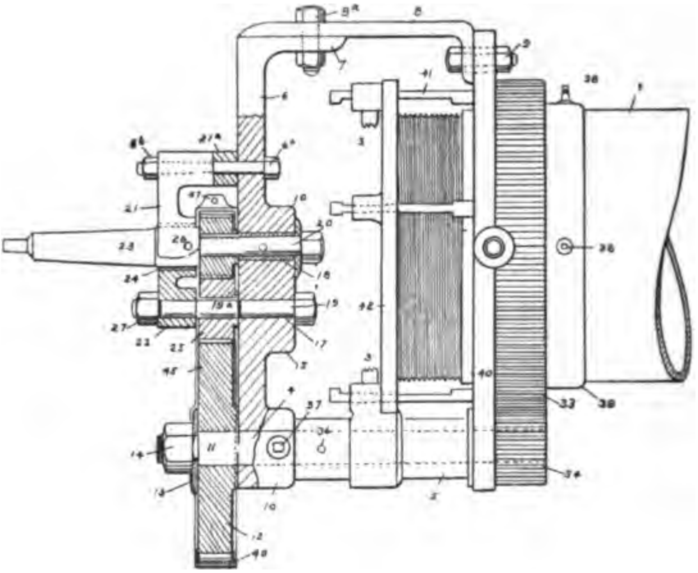
For power we used a No. 3 Chicago pneumatic compound geared drilling motor, taking air from the storage tanks, in which air for starting our gas engines is stored.

As will be seen from the drawing the pinion sleeve 5 is made about 2 inches longer than the original one furnished with the machine, to act as a support for the cross arm 6, the latter being supported on the opposite end by brace 8 which is rigidly bolted to the taper pin plate 40, and to end of arm 6.

Power is applied to taper shank 23, to which gear 26 is keyed fast, and which in turn sets in motion gears 25 and 12.

Gear 12 being fastened to pinion shaft 14, which is in one piece with pinion 34, drives the latter around the periphery of the large gear 33, which is fastened to the pipe to be threaded by means of set-screws 38.

In rotating, the driving plate 42 carrying the dies 3, is caused to revolve around the end of pipe to be threaded, and the dies are fed on the pipe by means of the lead screw which is in one piece with driving plate 42.



Wrinkle No. 39.

Proper taper is given by means of taper pins, against which the back of dies rest, and recede as, the lead screw feeds them on to the pipe.

Gear 12 is fitted to pinion shaft 11 by a square hole and held in place by washer "Y" cap screw.

By this means the square shank is retained on shaft 11 to permit the machine to be operated by hand, in case power is not available, the attachment being easily detached, by removing two bolts.

By using this attachment, a thread can be cut on 8″ pipe in twelve minutes, and we found this method to be easier on the dies, as the motion of the machine is more uniform, and the side thrust and jerking on the long lever is eliminated.

A suitable case protects the gearing from dirt, and also the operator from getting caught in the gearing.

WRINKLE NO. 40.

CARRYING COMPRESSED GAS ON FORD CAR TO BLOW OUT HOUSE LINES.

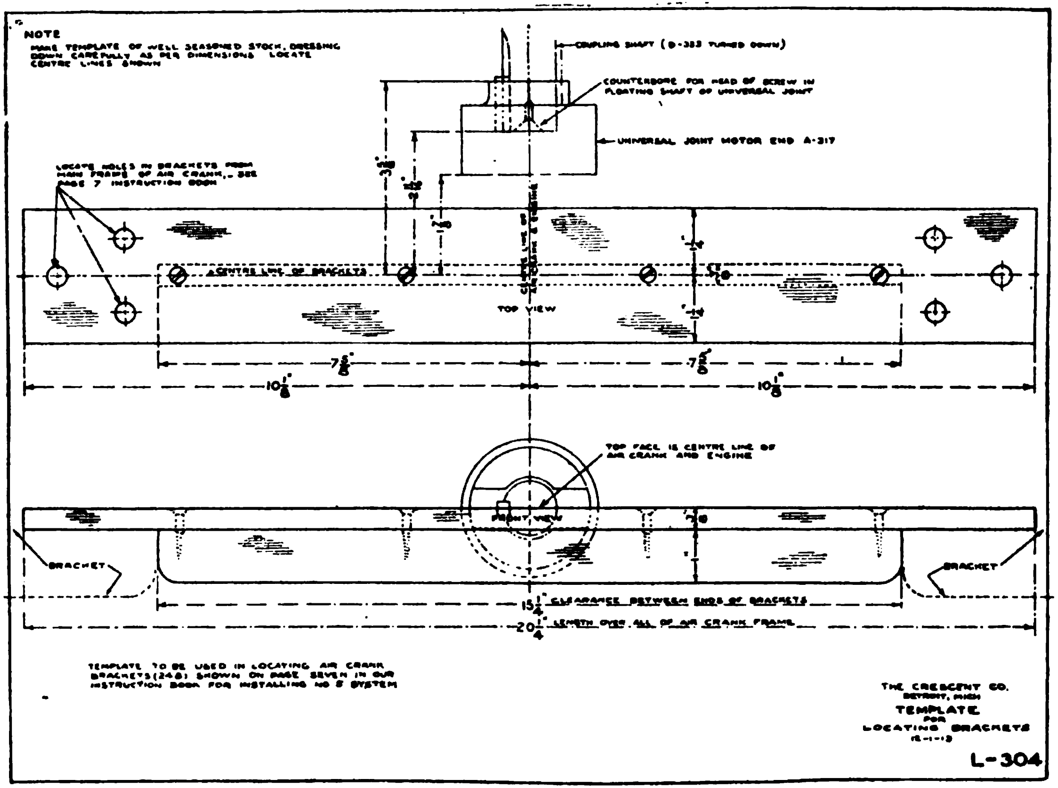
B. J. CRAHAN, SUPERINTENDENT, JOPLIN GAS CO.,
JOPLIN, MISSOURI.

I am showing a blue print giving details of compressor installed on the front of our Ford automobile for the purpose of blowing out services that become stopped, frozen or filled with corrosion of any kind.

Many gas companies today are using Ford cars, hence the great utility of this compressor as used in connection with your main and service complaint work. The compressor is attached to the front part of the car, a tank in which can be carried 500 pounds is placed underneath the machine which is always kept filled by the small compressor. An auxiliary tank is then used in which we carry from 100 to 125 pounds of compressed air charged from the larger tank.

In case of a stopped service we take this into the premises, disconnect the meter and shoot the high pressure into the service which immediately clears it. This not only saves us the cost but renewing many services that we could not otherwise clear, but in the winter months when we are troubled with frost complaints one man can do as much complaint work with this equipment as four men with ordinary hand pumps.

To a practical man this saving will be readily apparent, but I will furnish any further data that we are able to, and I feel that every member of the Association who attends the convention in May will be interested in this kind of device for clearing services as the older your plant becomes the more of this kind of work you will have to contend with.

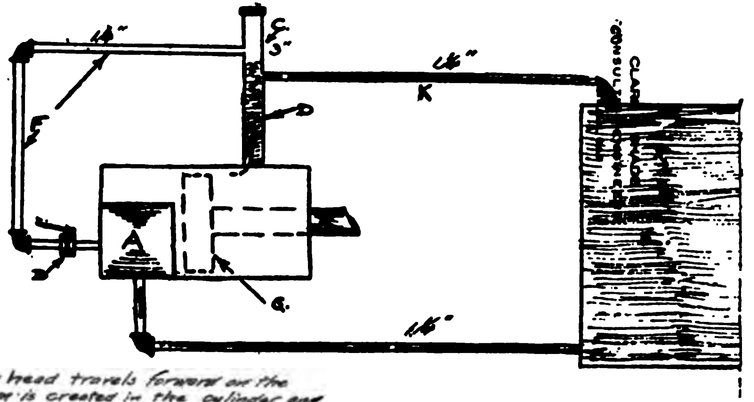

NOTE
MAKE TEMPLATE OF WELL SEASONED STOCK, DRESSING DOWN CAREFULLY AS PER DIMENSIONS LOCATE CENTRE LINES SHOWN
LOCATE HOLES IN BRACKETS FROM MAIN FRAME OF AIR CRANK, – SEE PAGE 7 INSTRUCTION BOOK
COUPLING SHAFT (D-333 TURNED DOWN)
COUNTERBORE FOR HEAD OF SCREW IN FLOATING SHAFT OF UNIVERSAL JOINT
UNIVERSAL JOINT MOTOR END A-317
CENTRE LINE OF BRACKETS
CENTRE LINE OF AIR CRANK & ENGINE
TOP VIEW
7 5/8"
7 5/8"
10 1/8"
10 1/8"
TOP FACE IS CENTRE LINE OF AIR CRANK AND ENGINE
FRONT VIEW
BRACKET
BRACKET
15 1/4" CLEARANCE BETWEEN ENDS OF BRACKETS
20 1/4" LENGTH OVER ALL OF AIR CRANK FRAME
TEMPLATE TO BE USED IN LOCATING AIR CRANK BRACKETS (2 & 8) SHOWN ON PAGE SEVEN IN OUR INSTRUCTION BOOK FOR INSTALLING NO 5 SYSTEM
THE CRESCENT CO.
DETROIT, MICH
TEMPLATE
FOR
LOCATING BRACKETS
12-1-13
L-304

Wrinkle No. 40.

VACUUM CIRCULATING WATER SYSTEM, FOR GAS ENGINES.

R.S. Shade, Tulsa, Oklahoma

A. Combustion Chamber
B. Throttle Valve.
C. Expansion Chamber.
D. Check Valve.
E. Tank.
F. Piping to A. and C.
G. Piston Head.
K. Discharge Pipe.



Explanation:— When the piston head travels forward on the intake stroke a vacuum is created in the cylinder and combustion chamber, thus causing a vacuum in F and C. This causes the water to rise in C and when the explosion takes place in the engine, pressure is put on the water in C which causes valve D to close and water to flow quickly through pipe K. The vacuum is controlled by valve B.

Clark & Shade
Tulsa City
per. R.S. Shade.

Wrinkle No. 41.

WRINKLE NO. 42.

AN INEXPENSIVE CLAMP FOR TEMPORARY LEAK REPAIR.

C. L. FREELAND, PRESIDENT, BRISTOW GAS COMPANY,
BRISTOW, OKLAHOMA.

In making temporary repairs of small leaks on gas lines we take a piece of strap iron, used to bundle sheet iron roofing (hardware stores generally throw these straps away), punch a hole in each end which leaves a space of about one inch, use a piece of belting or gasket rubber to cover the leak, and a two-inch stove bolt to draw the strap tight. This makes a very good and inexpensive clamp and is a very quick way to close a leak on a small line.

WRINKLE NO. 43.

WHAT TO DO IF THE TONGS WILL NOT CATCH.

C. B. MCELWAINE, KEWANNA OIL & GAS CO., WIRT, OKLA.

It is oftentimes found in using chain tongs on fittings that it is impossible to make both jaws of tongs engage said fitting in a workable manner. The shape of the fitting will not allow chain to circle, without throwing one of the jaws off center, which causes them to overbalance, or grip the pipe upon which the fitting is secured.

This difficulty is easily overcome by placing the handle of a trimo wrench, or like object, under the unruly jaw and upon the pipe. This brings the two jaws of tongs on a near level, the one jaw gripping the fitting to be turned and the other gripping the wrench handle which slides around the pipe as the fitting turns. For instance, the other day, while casing a well, we lost considerable time and were much annoyed by a thread protector sticking so that any amount of hammering failed to dislodge it. We having no lay tongs at hand the above was resorted to with success.

WRINKLE NO. 44.

HOW TO TAKE UP SLACK WITH TONGS.

C. B. McELWAINE, KEWANNA OIL & GAS CO., WIRT, OKLA.

When flanging up a line and it is found that union does not come together sufficiently to engage the nut on flange bolt, put the hook of tongs on one-half flange and jaw on other half and pull reins together. If there be any slack within reasonable distance this will get it.

WRINKLE NO. 45.

LINING UP THE STABBER IN DIFFICULT POSITION.

C. B. McELWAINE, KEWANNA OIL & GAS CO., WIRT, OKLA.

I have often seen in a deep and narrow ditch where the line is passing under a sewer or other obstruction, a gang spend considerable time in trying to get the joint started. The ditch being too close for a man to be at the joint and accurately line up, and the obstruction shutting off the stabber's view. If one goes back a couple of joints he can usually line the stabber up from that position.

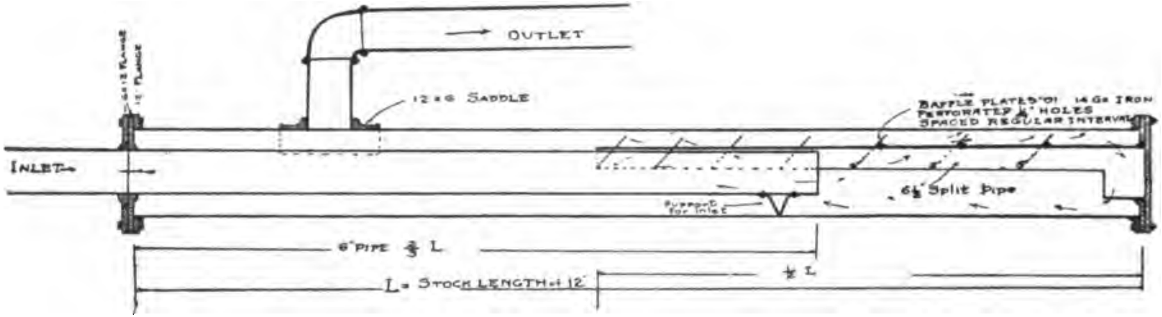
WRINKLE NO. 46.

DUST AND SALT TRAP FOR HIGH PRESSURE LINES.

J. F. OWENS, SUPERINTENDENT OF GAS DEPARTMENT, MUSKOGEE GAS & ELECTRIC CO., MUSKOGEE, OKLA.

I submit herewith sketch of trap or device for the removal of foreign matter from high pressure gas lines. This is intended to eliminate salt water, dust, oils and paraffine, and other foreign substances traveling through high pressure lines.

We have not attempted to make the length true to scale, in order that it might be reproduced to a two-column plate. It is purely diagrammatic to illustrate the principle only and not intended for a shop drawing.



SUGGESTED DUST AND SALT TRAP FOR HIGH PRESSURE FIELD LINES
By Muskogee Gas & Electric Co

Wrinkle No. 46.

WRINKLE NO. 47.

COMBINATION HIGH PRESSURE TAP AND REAMER.

Mr. Fred Dooling, Street Department, The East Ohio Gas Company, Cleveland, Ohio.

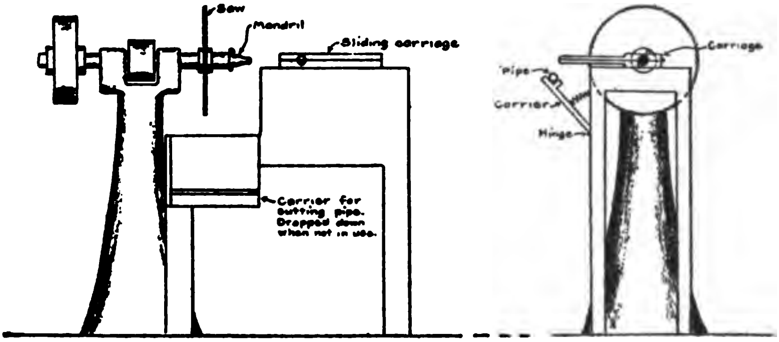
The accompanying drawing shows a high pressure drill and reamer, which we use in making all of our high pressure taps. In using this tool, we place the saddle, with the nipple and the gate on the pipe line to be tapped. Out of the gate we run a swedge nipple to two inch, on which we connect a tapping kit, equipped with drill and reamer, as shown in the accompanying drawing.

WRINKLE NO. 48.

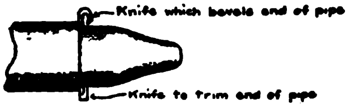
METER LEAD MACHINE.

Fred Dooling, Street Department, The East Ohio Gas Co., Cleveland, Ohio.

The meter lead machine shown in the enclosed drawing cuts the meter lead from the coil lead pipe on the saw, and the mandrel shown in the drawing enlarges the end so that the brass connection on the meter can be inserted.

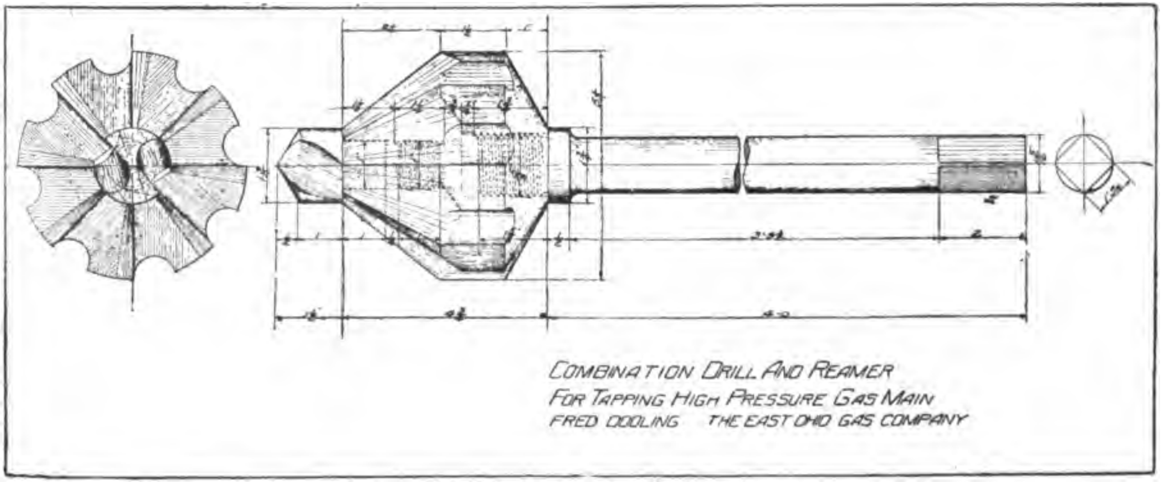


METER LEAD MACHINE



Detail of Mandril

Wrinkle No. 48.


COMBINATION DRILL AND REAMER
FOR TAPPING HIGH PRESSURE GAS MAIN
FRED DOOLING THE EAST OHIO GAS COMPANY

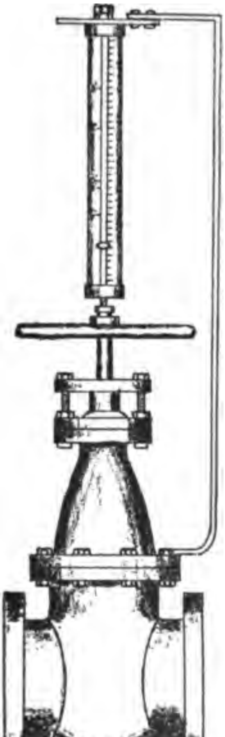
Wrinkle No. 47.

WRINKLE NO. 49.

GATE INDICATOR.

FRED DOOLING, STREET DEPARTMENT, THE EAST OHIO GAS CO., CLEVELAND, OHIO.

The gate indicator shown in the accompanying drawing is attached to a gate by tapping a ⅜″ hole in the top of the gate stem and fastening the worm in the gate indicator to the gate stem by means of a locked nut. The cylinder on which is stamped the graduations is held stationary by means of an iron strap. By means of this indicator anyone visiting a gate can tell immediately whether the gate is open or closed or how far open.



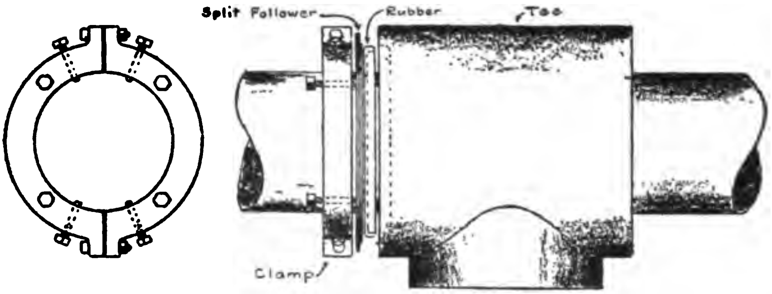
Wrinkle No. 49.

WRINKLE NO. 50.

FITTING LEAK CLAMP.

Fred Dooling, Street Department, The East Ohio Gas Co., Cleveland, Ohio.

The attached sketch shows a fitting leak clamp which we use to stop leaks on screw fittings. The band clamp shown on the drawing is made of one and one-quarter inch square steel, with five-eighths inch set screws. We use one of our regular steel split followers, as shown in the sketch, and by putting the clamp on the pipe and fastening it tightly by means of the set screws, we are able to push the split follower, containing the rubber, against the fitting.



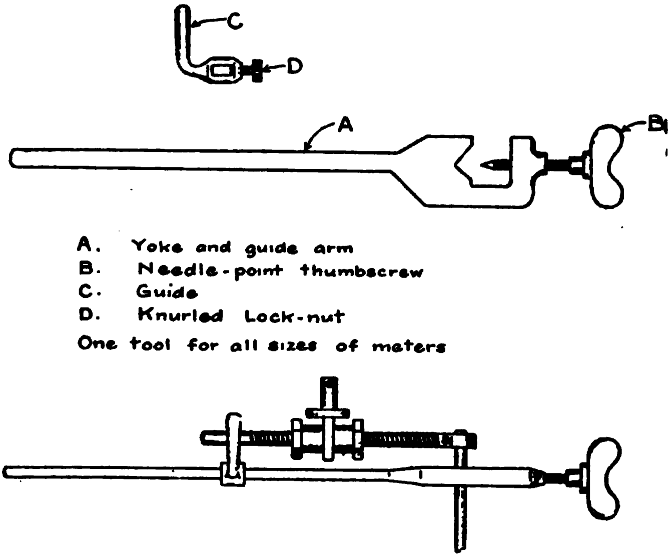
Wrinkle No. 50.

WRINKLE NO. 51.

TOOL FOR SETTING TANGENTS IN TIN METERS.

Mr. George Tucker, The East Ohio Gas Company, Massillon, Ohio.

To operate: Place yoke against bottom of tangent-bar on crank-stem, guide-arm against bottom of tangent-wrist and guide against side of tangent-bar. Hold in this position while tightening thumb-screw. This will make a depression in crank-stem. Tangent and tool may both be removed. To reset tangent place tool in position with point of thumb-screw in depression. Tangent must then go back to same position on crank-stem.

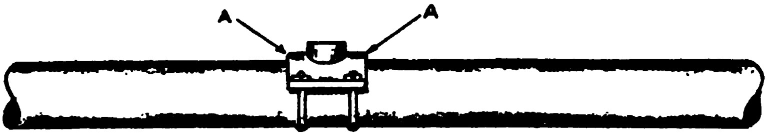


Wrinkle No. 51.

WRINKLE NO. 52.

CORRECT METHOD OF SETTING A SADDLE.

George Tucker, The East Ohio Gas Company,
Massillon, Ohio.



Wrinkle No. 52.

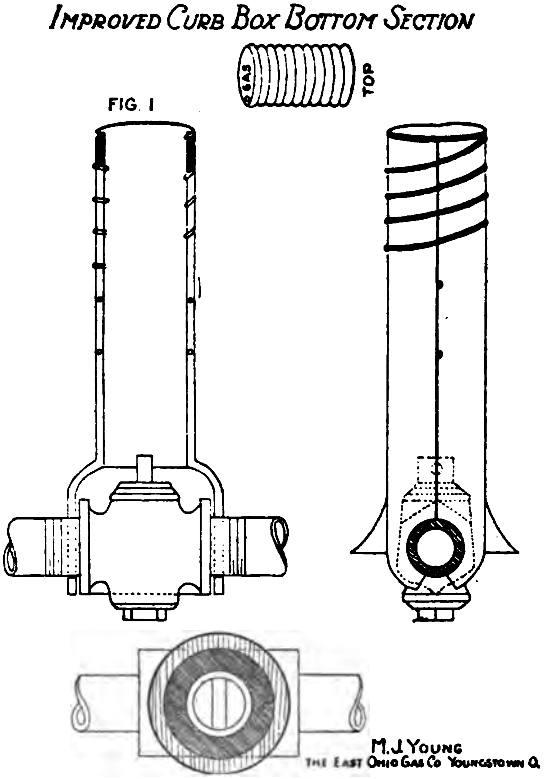
After saddle is in position and nuts tight, hammer saddle at points marked "A" driving it 1/8" to right, then back. Then tighten nuts again, repeat two or three times. This rubs out the high places in the lead and gives a correct bearing surface.

WRINKLE NO. 53.

IMPROVEMENT IN BOTTOM SECTION OF CURB BOX.

M. J. Young, Shop Foreman, The East Ohio Gas Co.,
Youngstown, Ohio.

The accompanying sketch shows an improvement which refers to curb boxes for encasing stop cocks of gas service pipes and similar devices buried in the ground. It refers more particularly to an improved bottom of a curb box, in which the parts are securely clamped to the service pipe in position over the cock, so as to prevent displacement of the box for any


Improved Curb Box Bottom Section
GAS
TOP
FIG. I
M.J.Young
The East Ohio Gas Co Youngstown O.

Wrinkle No. 53.

reason, and thus do away with the necessity of removing the box entirely to gain access to the cock; which process is often necessary with the ordinary curb box that merely rests on the pipe.

By having the lower section of the curb box made as I will describe, it could be used on the ordinary curb box which is now in use; that is, I mean the top casing and lid would be the same size as now used. The bottom which I have in mind and sketch illustrates, will be composed of two parts which are semi-tubular and co-operate to form a cylindrical structure through the hollow of which access to the stop cock is had. The lower ends of the members are enlarged to form a chamber for receiving the stop cocks. The longitudinal meeting edges are cut away in the shape of semi-circular notches which notches co-operate to form a circular opening, through which the ends of the service pipe extend. Thus, the lower ends of the members are formed into jaws for gripping around the service pipe, adjacent the ends of the stop cock.

As shown in sketch Fig. 1, the notches closely encircle the service pipe and the end walls of the chamber are disposed adjacent the ends of the cock, so that lateral displacement of the casing with respect to the stop cock is prevented by the said walls of the cock. Furthermore, by means of the hook-shaped jaws formed at the lower ends of the members by the notches, the casing is prevented from moving vertically, independently of the pipe.

The two parts may be secured together in any desired manner; by preference, however, the parts are held in place by means of the curb box top section, or sleeve. The two parts should be made with lugs to interlock so as to permit the sleeve to be adjusted to different heights according to depth of the service pipe below the surface of the ground or street.

The idea, to which I refer, is to my mind a great improvement in the curb box and would be a benefit to all gas companies.

WRINKLE NO. 54.

CARE GIVEN TO MOTORCYCLES AND BICYCLES.

M. J. YOUNG, SHOP FOREMAN, THE EAST OHIO GAS CO.,
YOUNGSTOWN, OHIO.

To help eliminate lost time in repairing motorcycles and bicycles, which are important factors in the gas business, I submit this Wrinkle.

These machines are considered one of the greatest necessaries in providing a means in taking care of turning on and off gas, as well as being a great advantage to a collector who may be handling the accounts on the Shop Ledger which are scattered in different parts of the city. Like other machinery, they require constant attention and must be taken care of in order to secure service from them.

To enable us to keep these in good condition, we have arranged that fifteen minutes each day immediately following lunch be devoted to the cleaning, examining and repairing of all motorcycles and bicycles used in our shop. This work is done while our shop clerk is preparing the orders for distribution to the different men and is a great success. As we find that we secure the proper service from our machines and that we very seldom are compelled to permit our motorcycles or bicycles to remain idle for repairs in our shop, which is, no doubt, a saving in time and labor.

We have also placed on the rear of all motorcycles a small galvanized sheet iron tool box which we find very convenient to carry plugs, caps, and other necessary material which are frequently needed when one of our men goes to turn on gas and finds a line open. He can immediately cap the line and this is a means by which an unnecessary trip is averted. There is also carried in this tool box an extra inner tube tire and in case of a puncture, he need not stop to repair it on the street, but changes the inner tube and makes the repairs at a more convenient time. We have also placed on one of our motorcycles a "Prest-o-light" and tank for the use of our night pressure man when he is answering fire alarms or other emergency calls at night.

WRINKLE NO. 55.

METHOD OF TAGGING HOUSE LINES IN APARTMENT HOUSES.

M. J. YOUNG, SHOP FOREMAN, THE EAST OHIO GAS CO.,
YOUNGSTOWN, OHIO.

We formerly experienced considerable trouble in keeping house lines in apartment houses tagged so as to enable us to distinguish the separate lines for the different apartments. Heretofore we were using common shipping tags, which we marked and placed on lines near the meters. We did not find this to be satisfactory, as after a short time the tags would become dirty and curled up, making it difficult to read them.

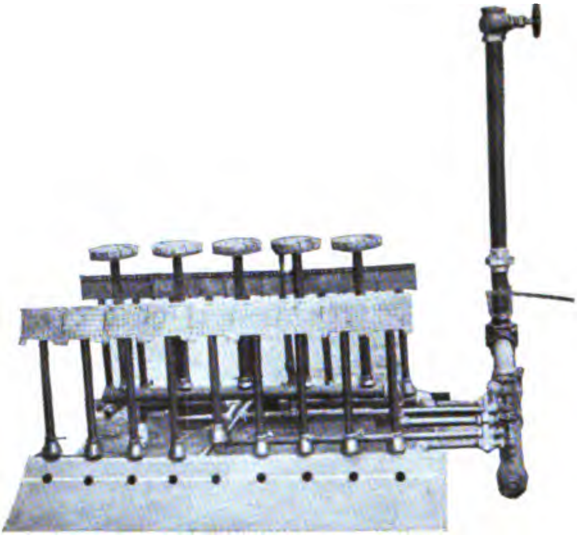
Instead of this common shipping tag we are now using a small piece of galvanized sheet iron, which is marked by a small paint brush with the number of the apartment and the location of same to which line extends. By having all lines in apartment houses tagged at the meters, it enables us to distinguish the meter that supplies the apartment to which that line extends. By using this galvanized sheet iron tag and fastening same to house line with copper wire, it eliminates the work of re-tagging lines and also presents a much neater appearance.

WRINKLE NO. 56.

SHOWS NEW BURNERS AND TELLS NECESSITY OF PROPERLY BUILT CHIMNEYS.

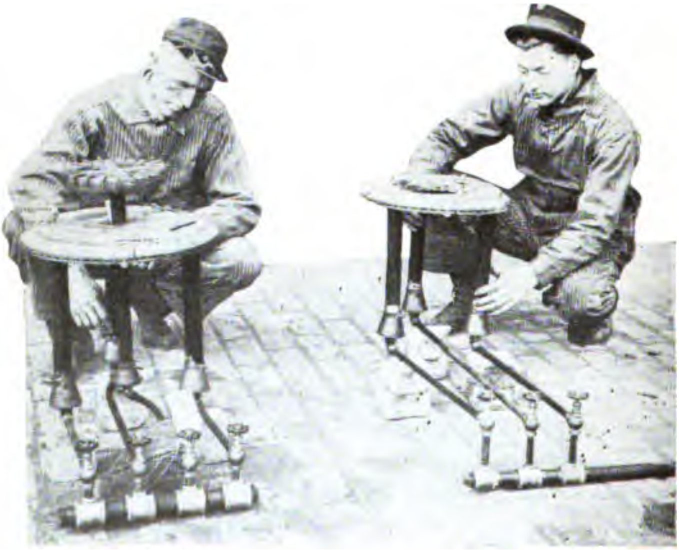
W. P. TIBBENS, GENERAL SHOP FOREMAN, THE EAST OHIO GAS
COMPANY, CLEVELAND, OHIO.

In explanation of the photographs on page 164, we show our newest installation for round fire-pot furnaces for warm air heating, also for steam and hot water furnaces. The one to which I most particularly call your attention is the square or rectangular furnace installation, which I have classed as a 45° burner. This is the newest installation on the market and one that is proving very satisfactory here in many large residences and also apartment house furnaces. It seems to meet the long felt want in the burner line for this particular work and I trust it may be of some interest to our fellow workers in other gas cities and towns.



Wrinkle No. 56.

This the Sheet Iron Used for the Bottom at Grate Line, the Grates are Removed. Side View of Improved Burners. Note the 45 Degree Side Burners.



Wrinkle No. 56.

Fred Gunthrop with Center Burner for Hot Water Furnace and Walter Welsh with Three Section Warm Air Furnace Burner.

It also appeals to me that we, who are directly interested in the business of heating and cooking with natural gas, should request architects in general to build practical brick chimneys with a tile lining for all grates, furnaces, ranges, and laundry stoves that will be suitable for coal appliances when desired, as well as for gas.

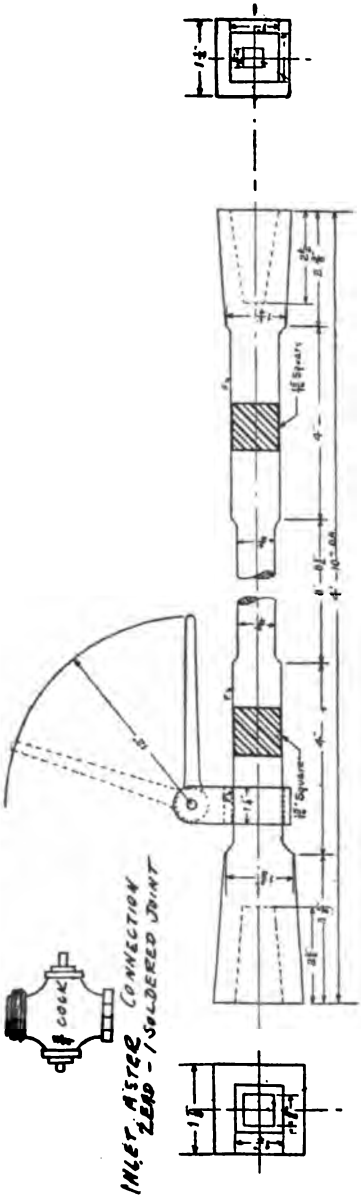
It seems to be the general opinion of the architects and builders that gas as fuel needs very little draft and that a three- or four-inch tin pipe running out through a side wall is sufficient for a gas grate or a gas range. If we can prevail on the above designers and builders that this type of flue, namely, the tin flue, is dangerous to both life and property, and ask them to spend a few dollars for chimneys of proper construction for coal, there will never be any question about its safety and general efficiency of gas. I would add to this that in building fireplaces for gas grates that the side and back walls and overhead arch and flue opening from fireplace into flue, be made of the proper size and fire brick construction so that it could be used for coal or wood at any time in case of a failure of gas or the desire on the part of the occupant to use coal or wood in place of gas. It might be advisable to have drawings made showing the proper construction of such fireplaces and show such drawings in your Wrinkle Book which will help to get our ideas before the architects and builders. If we succeed in doing this, we will relieve all the gas companies furnishing gas for fuel purposes, of not only a great responsibility in regard to damage cases through fire and sickness from burned gas escaping into the rooms, and in some cases, total asphyxiation.

WRINKLE NO. 57.

COMBINATION GATE VALVE KEY.

PATRICK KENNEDY, THE EAST OHIO GAS CO., CLEVELAND, O.

The accompanying drawing shows a combination gate valve key which fits all sizes of gates from 3-inch to 12-inch. One end of the key fits 3, 4 and 6-inch valves, and the other end fits 8, 10 and 12-inch gate valves. The handle slides from one end to the other.



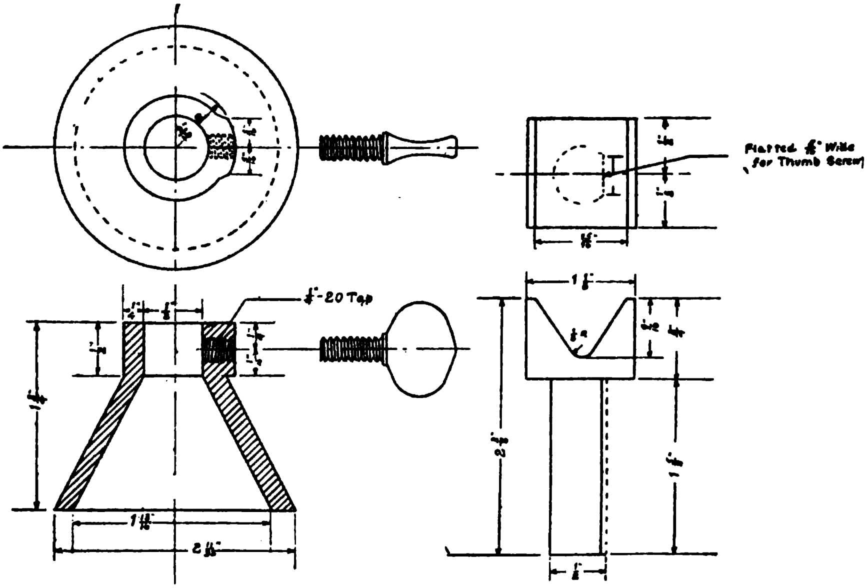
Wrinkle No. 57.

WRINKLE NO. 58.

ADJUSTABLE PIPE SUPPORT.

OLIVER WESTON, FITTER, THE EAST OHIO GAS CO.

The accompanying drawing shows a small adjustable pipe support used to support the small leads from the valves to the mixers in hot air furnaces. This support is used in place of bricks and we find it very convenient.



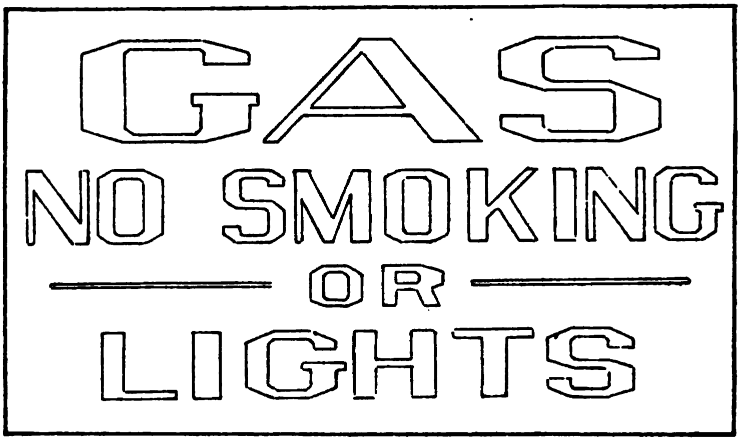
Wrinkle No. 58.

WRINKLE NO. 59.

DANGER SIGN.

H. F. THOMAS, PRESSURE DEPARTMENT, THE EAST OHIO GAS COMPANY, CLEVELAND, OHIO.

The cut shown above is a reproduction of a sheet metal sign, red enameled with white letters which is nailed close to the door of factory regulator houses so that all factory employees who enter the regulator house are reminded to keep lights and fires away.



Wrinkle No. 59.

WRINKLE NO. 60.

CURB BOX ADJUSTING TOOL.

F. P. PATTERSON, THE EAST OHIO GAS CO., DENNISON, OHIO.

In changing the grade of a street or in cases where the box has been buried too deep, it is necessary to raise or lower the curb box accordingly.

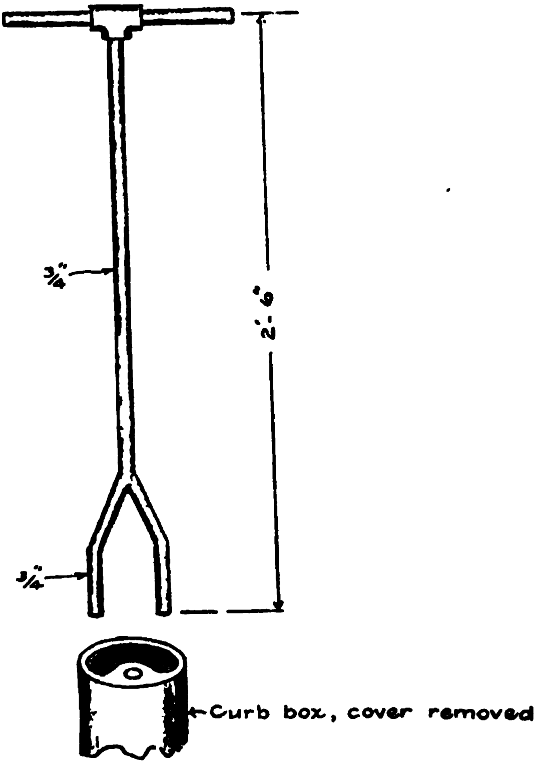
The tool shown in drawing (p. 157) fits inside of the upper section of the curb box. The box can be raised or lowered by turning the tool.

WRINKLE NO. 61.

METHOD OF MAKING MAP TO EITHER REDUCED OR INCREASED SCALE.

E. M. WERNER AND P. S. WHELAN, LEASE DEPARTMENT, THE EAST OHIO GAS CO., CLEVELAND, OHIO.

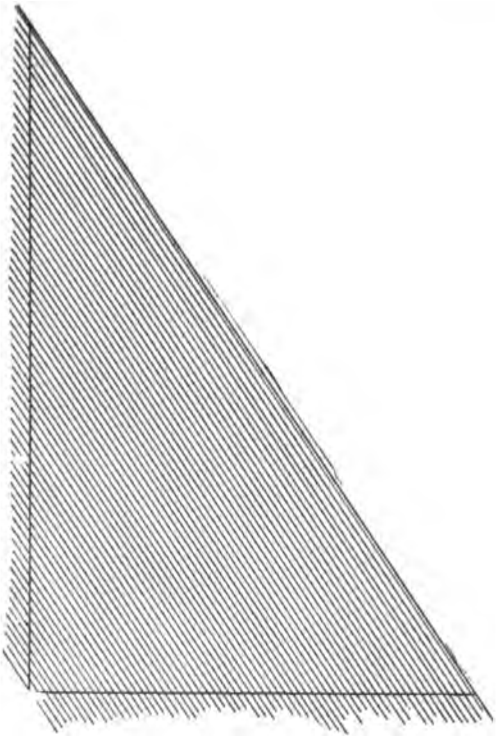
Draw a right angle with the two legs in length proportional to the scales of the original and required maps. The hypotenuse of a right triangle will be a line drawn between the ends of the two legs. (Page 158.)



Wrinkle No. 60.

Draw lines parallel to the hypotenuse graduated in 1/16", on short leg if scale is to be larger, on long leg if scale is to be smaller, using four or five colors in ink.

Example: — Suppose scale of original is 300 ft. per in. and scale of required map 400 ft. per in. Draw right angle with one leg 6" long, other 4" long. Draw hypotenuse, graduate short leg in 1/16". Take measurements from original map, step off on short leg from right angle corner. Divider point will fall on or near one of graduations. The distance from the right angle to where the hypotenuse drawn from this point intersects the long leg will be the required distance on map. These triangles being similar, the corresponding sides are proportional.



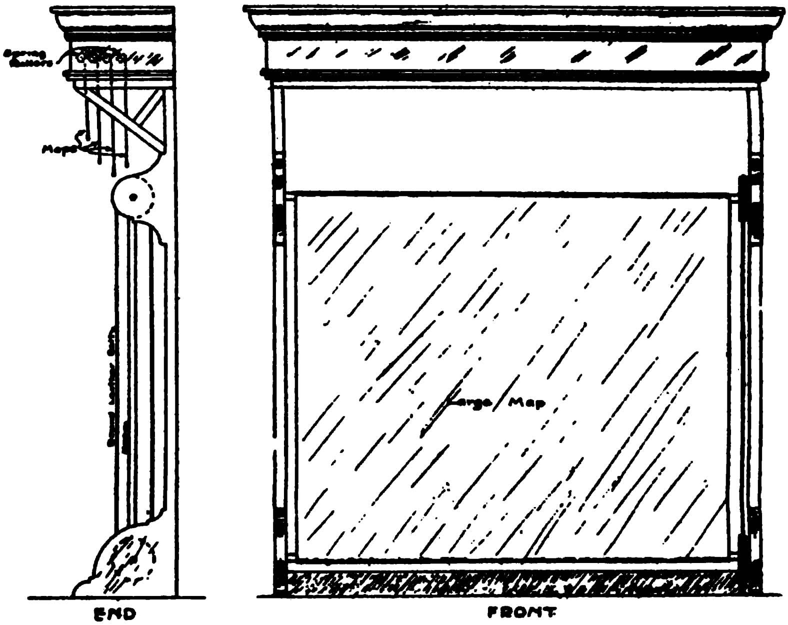
Wrinkle No. 61.

WRINKLE NO. 62.

MAP CASE.

EDWARD SMITH, MANAGER FIELD DEPARTMENT, THE EAST OHIO GAS COMPANY, CLEVELAND, OHIO.

The accompanying sketch shows a convenient case for large maps. The map most frequently used is placed on rollers arranged so that it unrolls on the upper roller while it rolls on the lower one. The map can be much longer than the distance between rolls.



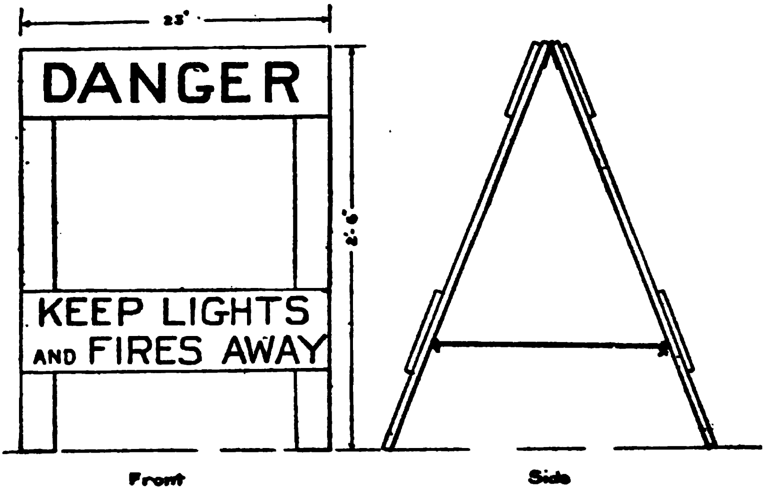
SKETCH OF MAP CASE
Wrinkle No. 62.

WRINKLE NO. 63.

MANHOLE PROTECTORS.

C. O. McKlveen, Pressure Department, The East Ohio Gas Company, Cleveland, Ohio.

The accompanying drawing shows the manhole protectors commonly used by this company. This protector is placed a few feet away from the manhole as soon as the manhole cover has been removed. It is painted red and has white lettering.



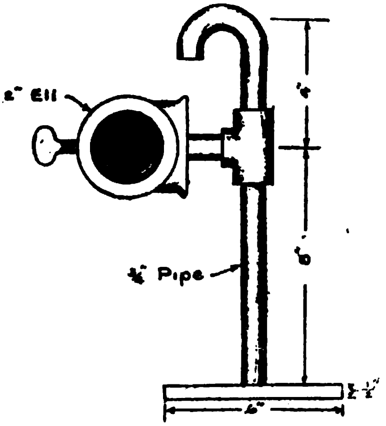
Wrinkle No. 63.

WRINKLE NO. 64.

ADJUSTABLE FLASHLIGHT HOLDER.

Louis Erck, The East Ohio Gas Company, Canton, Ohio.

The accompanying sketch shows a combination stand and hanger arranged to hold a flashlight at any angle so that a workman can spot a light on the work and use both hands at the same time.



Wrinkle No. 64.

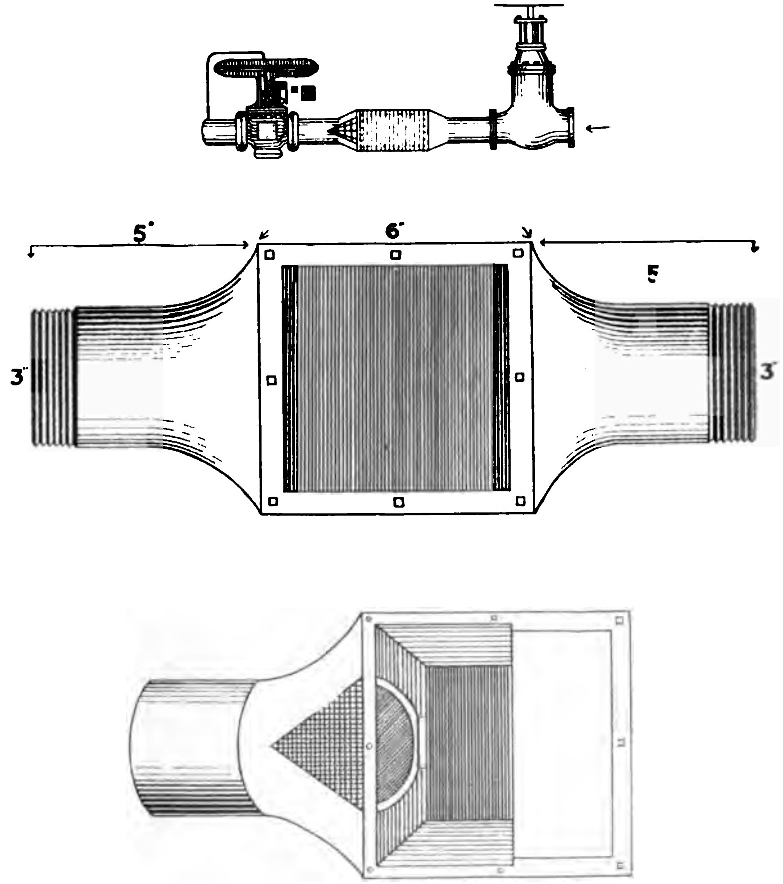
WRINKLE NO. 65.

REGULATOR CLEAN-OUT BOX.

J. C. Scoville, The East Ohio Gas Co., Akron, Ohio.

Drawing shows special casting to be installed on inlet side of regulator with hand hole cover in both sides. Screen to be in casting instead of regulator and held in place by lugs on plates.

In this way, if regulator is to be cleaned, plates can be removed and screen taken out without removing regulator.



Wrinkle No. 65.

Hand hole should be as near regulator as possible so regulator valves can be removed through hand hole.

WRINKLE NO. 66.

PLACING SAFETY TANK BETWEEN VALVE AND PRESSURE GATE.

A. J. QUINLAN, GENERAL FOREMAN, THE EAST OHIO GAS COMPANY, AKRON, OHIO.

Please find enclosed a drawing which I wish to present to you as a wrinkle. Heretofore, we have always had safety tanks connected into a tee, which was placed on the outside of the outlet gate.

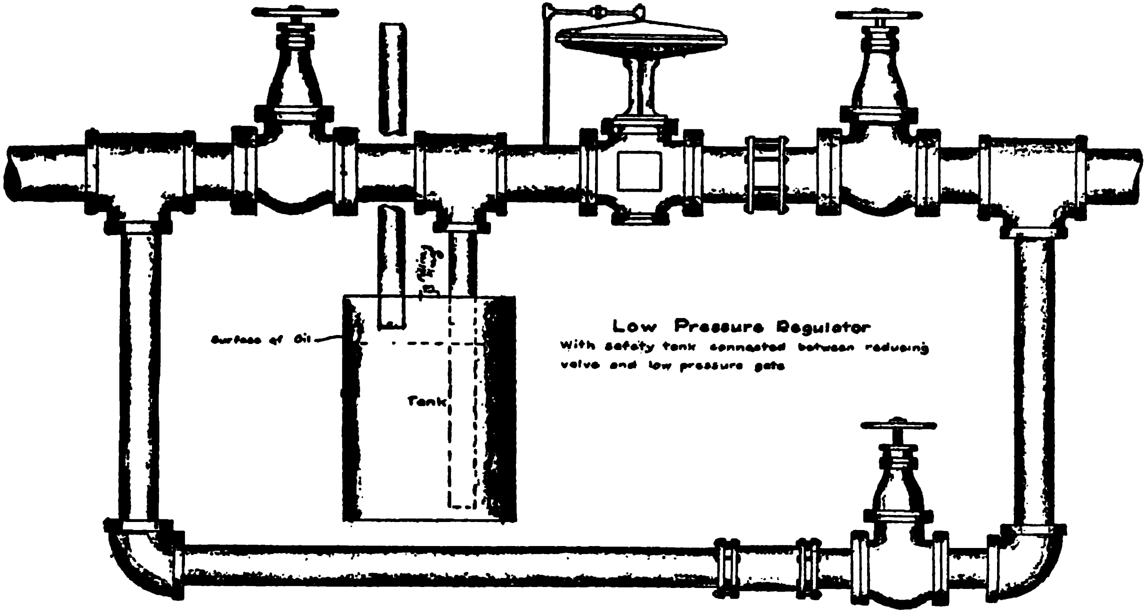
Upon numerous occasions the seal has been blown from various tanks, caused by the regulator sticking or something getting under the seat of the valve, which prevented its closing.

By placing the inlet to same between the two gates it enables the regulator man, or whoever might be called in case of blowing the seal, to close the inlet and outlet gate of the installation, thereby shutting off the safety tank line.

The plug at the top of the tank can then be removed without fear of gas affecting the man in filling the tank in the pit. We have found it necessary in refilling these tanks that, in order to do so with safety, to take water from the nearest hydrant and place hose on the outlet pipe and then wrap a blanket around same, in order to prevent gas from escaping in the air while filling the seal.

I know of instances where operating companies install a gate back of the safety tank. This, in my opinion is not a good provision, inasmuch as when you blow the seal and shut the gas off of same with gate, upon numerous occasions I have learned where, after filling tank, the gate was not opened. In other words, during my experience as an inspector, I have found many tanks out of commission on account of said gate being closed.

It is my opinion that this will save a great deal of inconvenience as well as adding to the safety of the regulator man.


To filling plug
Surface of Oil
Tank
Low Pressure Regulator
With safety tank connected between reducing valve and low pressure gate

Wrinkle No. 66.

WRINKLE NO. 67.

A UNION USED TO BREAK UP THE FLOW OF ELECTRICITY FROM GAS WELLS TO HIGH PRESSURE DISTRIBUTION LINES.

C. W. Gardner, Electrolysis Engineer, The East Ohio Gas Company, Cleveland, Ohio.

It has been found that gas wells, in the vicinity of street railway lines and especially the lines of interurban railway systems, frequently pick up large electric currents and ordinarily deliver them to the high pressure piping system on which they flow to a point near the substation and pass from there through the ground to the negative bus bar, resulting in the destruction of the pipe by electrolytic action. In order to prevent the current from reaching the mains we have used a flanged union with insulation sufficient to keep the two joints of pipe, which it connects, from being in metallic contact. The accompanying drawing shows in detail the construction of the union when assembled and does not need further explanation.

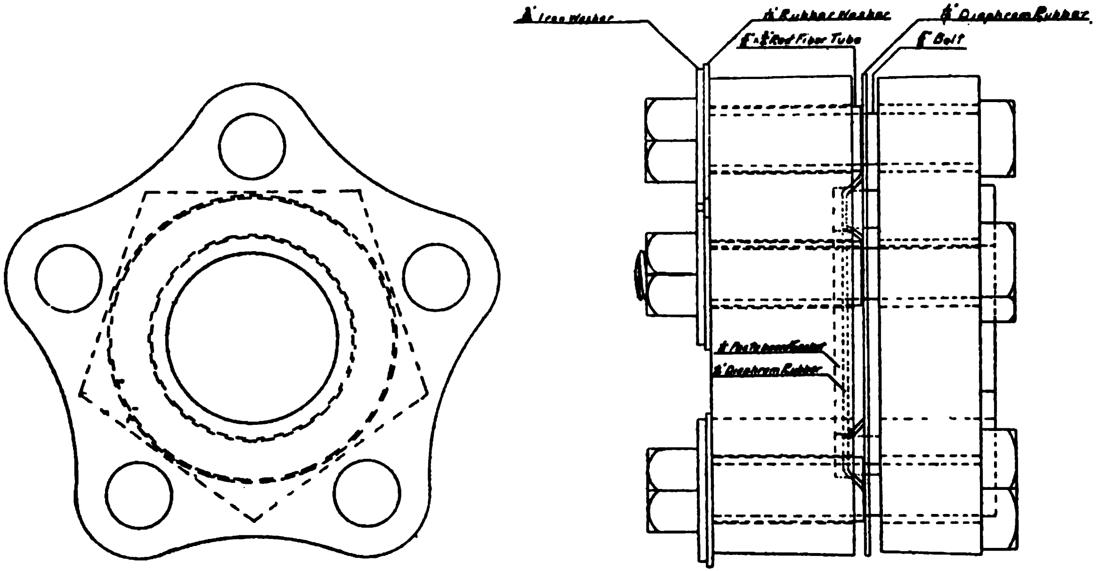
This union is inserted in the run of pipe from the well to the orifice flange which is above the ground, thereby making it impossible for any current to pass through it.

WRINKLE NO. 68.

COMMON CAUSE OF LOW PRESSURE.

Efficiency Department, The East Ohio Gas Company, Cleveland, Ohio.

One of the most common causes of low pressure gas in homes is due to the curb stop-cock being partially closed. This frequently shows up in zero weather when the consumer requires the full capacity of the service line to heat his home. In some cases it may be necessary to lower a flash light down into the curb box to determine whether or not the stop-cock is wide open.



Insulating Flange Union

Plan View
of
Union not Assembled

Side View of Assembled Union

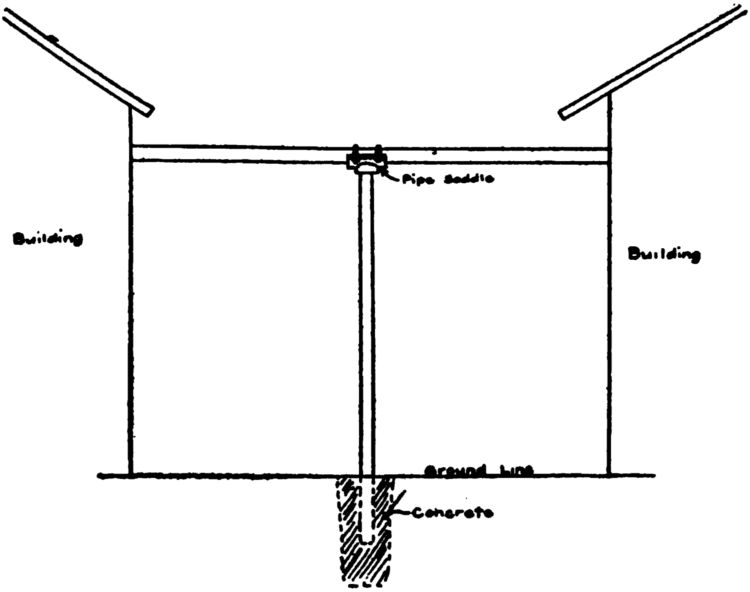
Wrinkle No. 67.

WRINKLE NO. 69.

PIPE SUPPORT.

The East Ohio Gas Company.

The accompanying drawing shows a method of supporting a pipe above ground. For instance, an eight inch pipe which runs overhead from one building to another at a height of ten feet could be properly supported by a 4 inch pipe imbedded in a few feet of concrete. The 4 inch pipe would be fastened to the 8 inch pipe by an 8 x 4 saddle.



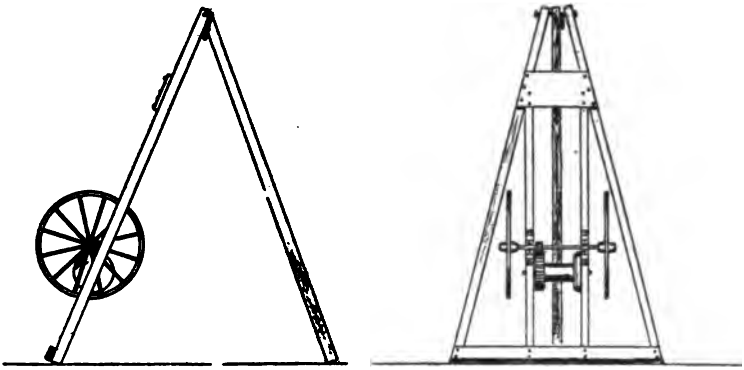
Wrinkle No. 69.

WRINKLE NO. 70.

PORTABLE DERRICK.

The East Ohio Gas Company, Cleveland, Ohio.

The enclosed sketch shows a portable derrick which is very convenient for use in stock rooms for loading heavy material on trucks or for handling heavy fittings. In moving this derrick it can be tipped over onto the wagon wheels and pulled from place to place.



SIDE END

PORTABLE DERRICK

Wrinkle No. 70.

WRINKLE NO. 71.

STUB HOLDER.

G. F. Brown, Cashier, The Dominion Natural Gas Company, Simcoe, Ont., Canada.

When wishing to enter up the day's collections, place stubs in upright position, as shown in holder, as information is entered stub is then placed on side holders as desired.

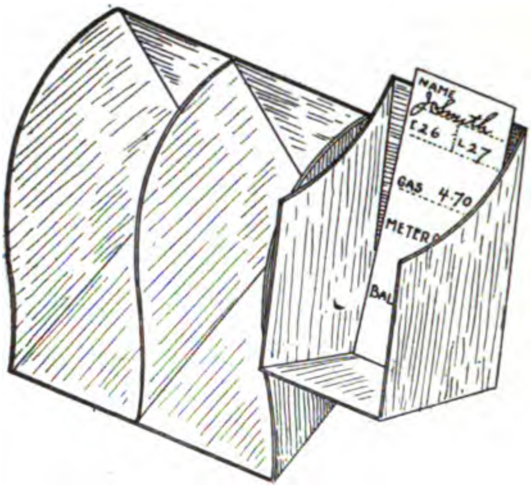
Keep stubs in front for convenience in entering and serves as very convenient holder.

WRINKLE NO. 72.

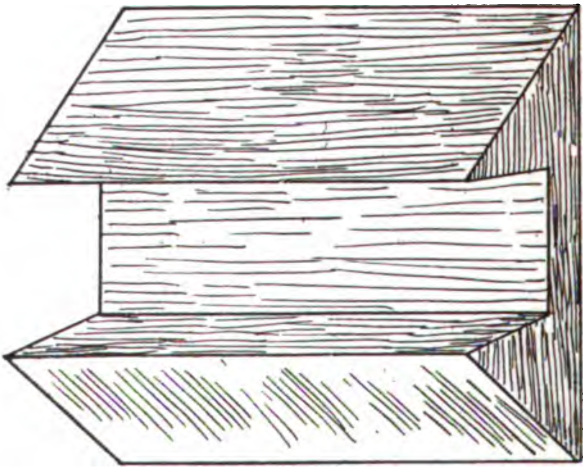
FOR HOLDING METER BOOKS, STYLE THAT BOTH COVERS ARE HINGED.

G. F. Brown, Cashier, The Dominion Natural Gas Company, Simcoe, Ont., Canada.

For holding meter books open on desk when entering readings, etc., place meter book back part in groove of cut, and covers fall each way; slips may then be turned at will with no fear of turning over themselves and thus losing your place or having to hold slip in meter book while working with same.



Wrinkle No. 71.



Wrinkle No. 72.

WRINKLE NO. 73.

FORMS USED IN HAMILTON, CANADA.

H. C. FELTON, GAS COMPANY, HAMILTON, ONT., CANADA.

I am showing a couple of "wrinkles." They are very simple but efficient in many ways.

Perhaps they will help someone else in the business, and that is just what we are in business for.

Service Ordered..

No..Street............................Service No.........................

	Application No.	Date Applied	Inspection and Meter Orders	Security
	Service			
	Gas			

Applications of course are filed as to number.

By referring to your Service No. you can at once turn to Service Order slip and the full information, diagrams, etc., are before you.

These cards could be ruled on other side and thus prolong the life of the card.

(Size: 4 x 6 in.)

Wrinkle No. 73.

(FRONT)

Service No........................... ....19........

Service for..

....**Street** ....

MAIN TO CURB

Size.	PIPE		Nips	Ells.	Tees	Plugs	Bush	Service Cock	F. Union	Reduc's			SADDLE
	Ft.	In.											1.....x......
1"													CURB BOX
1¼"													1 No.......
1½"													
2"													

Filled in by Foreman.

Fitter .... **Hours**..................

Helper and Wagon.. **Hours**..................

Labor .... **Hours**..................

Foreman's Time..

INSIDE CURB

Size.	PIPE		Nipples	Ells.	Tees	Plugs	Bush	Gas Cocks	G Valves	Unions	F. Union	Reduc's			Miscellaneous
	Ft.	In.													....
1"															....
1¼"															....
1½"															....
2"															....

Filled in by Foreman.

Fitter .... **Hours**..................

Helper and Wagon.. **Hours**..................

Labor .... **Hours**..................

Foreman's Time..

ITEMIZE EXTRA FITTINGS IN BLANK LINES

....

....

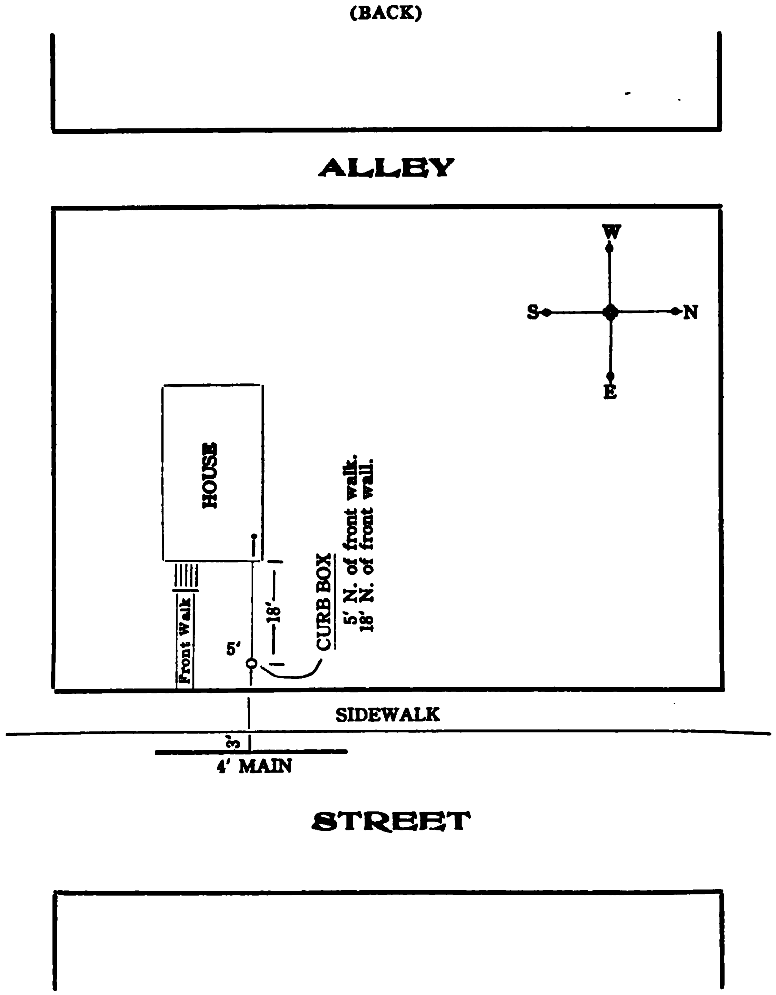
....

....

See Diagram below. These are bound in books of hundreds according to numbers.

(Bound on this edge)

Wrinkle No. 73.



We also use Hydro poles, which are concrete, as markers; no doubt they will last as long as Gas pipe. These poles are on every street, and are numbered very plainly. We say so many feet E. as the case may be from H. E. Pole No. 7781, etc.

(Size: 4¼ x 8½ in.)

Wrinkle No. 73.

SETS.

$$\begin{array}{r}1850\\1000\\\hline 850\end{array}$$

American 5	Sprague 5	Tobey 8	Ironclad 1	Eq. 2	Eq. 3	Pittsburg 5	Ohio 5
906312 60	1690 40	242814 90	etc. 10	etc. 40	etc. 80	20	10

PREPARATION OF METER REPORT.

1. Inventory is taken 1st of each month.
2. Operations are listed during month on sheets like this one as follows:
    1. Sets.
    2. Removals.
    3. Meter change sets.
    4. Meter change removals.
3. These are then checked by drawing red lines thru sets if they are found on Removals or Inventory or have been purchased during month. This can be done each day if business warrants it, thus saving time if numbers do not check out correctly.
4. At the end of the month all meters not checked out of Removals, Inventory or Purchased Lists must turn up in warehouse at the next Inventory. By this method no meter can go astray or be lost unless by actual destruction. For nine years I have been keeping meter reports and have not yet lost a meter.
5. The result of the month's operations are then totaled and carried to summary, which in turn are carried on to Meter Report (blanks attached). If the listing and checking is kept up to date very little trouble will be experienced in the balance at the end of the month.
6. The difference between the number of the Set started with and the one ending must be the same as the number of meters listed on that particular sheet, as the case may be.
7. If a warehouse man is kept it is a good thing to let him list meters "in and out" each day; it is a handy record sometimes for references.

(Size 8½ x 14 in.)

Wrinkle No. 73.

SUMMARY METER OPERATIONS FOR FEBRUARY, 1916

Make	Size	Sets	Changes		Removals	Meter	
			Sets	Rem'ls		Inc.	Decr.
American	5	60	6	4	2	60	
Sprague	1	40	4	18	9	17	
Tobey	3	90	9	4	4	91	
Ironclad	1	10	3	11	0	2	
Eq. 2	2	40	10	8	44		2
Eq. 3	3	80	21	5	10	86	
Pittsburg	5	20	8	7	23		2
Ohio	5	10	4	8	16		10
		350	65	65	108	256	14

Check

Put In.	350 65	Takn Out.	65 108	Recd new	237
				Dec. Feb.	17
	415		173		254
				Con'd	12
Set. Rem.	350 108	Inc'r. Decr.	256 14		242
				Inc'r Sets	
	242		242		

(Size: 8½ x 9¾)

Wrinkle No. 73.

METER REPORT. For Month Ending February, 1916.

KIND	DURING THE MONTH							TOTAL METERS OWNED BY COMPANY	LOCATION AT THIS DATE		
	SIZE	RECEIVED NEW	SOLD OR CONDEMNED	PUT ON		TAKEN OFF			IN WAREHOUSE	IN USE	
				DOMESTIC	SPECIAL	DOMESTIC	SPECIAL			DOMESTIC	SPECIAL
American	5	117	1	66		6		900	10	890	
Sprague	1		5	44		27		300	8	292	
Tobey	3		2	99		8		200	21	179	
Ironclad	1			13		11		300	4	296	
Equitable	2	110	1	50		52		400	31	369	
Equitable	3		1	101		15		800	8	792	
Pittsburg	5	10		28		30		250	6	244	
Ohio	5		2	14		24		445	24	421	
Totals for the month		237	12	415		173		3595	112	3483	
Total number of meters as of this date.								3595	112	3483	
Total number of meters per previous report.								3370	129	3241	
Increase or decrease for the month (decrease in red ink.)								225	17	242	

SERVICE REPORT. For Month Ending..........

SERVICES	NUMBER OF SERVICE						REMARKS
	...IN.	...IN.	...IN.	...IN.	...IN.	...IN.	
Put in during month,							
Previous report,							
TOTAL TO DATE							

CITY LINES OPERATIONS. For Month Ending..........

LINES	NUMBER OF FEET OF PIPE						REMARKS
	...IN.	...IN.	...IN.	...IN.	...IN.	...IN.	
Laid during month,							
Taken up during month,							

(Size: 8½ x 12½ in.)

Wrinkle No. 73.

METER ORDER

	L. F.
CONNECT	**REMOVED**
For	**For**
St.	**St.**
Meter No. **Size**	**Meter No.** **Size**
Kind	**Kind**
Index	**Index**
Date Set	**Date Removed**
Date Turned on	**Date Turned off**
By	**By**
Fitter	
What used for	

Order No.

Trouble Office Copy, filled out by Meter Man. This is the original Order. The Blue one stays at office always. (Size 4 x 6 in.)

This Order is used on four occasions.
1. Set.
2. Removal.
3. Meter change known by A in front of No.
4. Transfer known by B in front of No.

METER ORDER

	***No.**
	L. F.
CONNECT	**REMOVED**
For	**For**
St.	**St.**
Meter No. **Size**	**Meter No.†** **Size**
Kind	**Kind**
Index	**Index**
Date Set	**Date Removed**
Date Turned on	**Date Turned off**
By	**By**
Fitter	
What used for	

‡Book Order No.

Ledger keeper's copy used on the Book and Report work.
*This No. is used or given one when it is completed and ready for Ledger keeper.
†This number is put on each day by numbering machine.
‡This No. is used by trouble department keeping record of orders out. This number is put on by printer. (Size 4 x 6 in.)

Wrinkle No. 73.

WRINKLE NO. 74.

SIMPLE AND EFFECTIVE BURNER INSTALLATION IN COAL HOT AIR FURNACES.

R. A. FREVERT, INDUSTRIAL ENGINEER, COMMERCIAL DEPARTMENT, THE COLUMBUS GAS AND FUEL COMPANY, COLUMBUS, OHIO.

The drawings herewith show another method of equipping coal hot air furnaces for gas fuel.

The two burners used are set one above the other. We use one 1½" tube with 7/64" orifice and one 1¼" tube with 3/32" orifice. These tubes are set in place so as to allow the flame to enter at one side of the fire bowl, the flame coming just over a small opening to admit secondary air, from the ash pit.

In this way, the flame is made to travel around the outer surface of the fire bowl, and preventing its rush to the flue pipe, by means of a circular baffle, built of fire bricks, as shown in the drawing. This wall, or baffle, of fire brick has its opening to flue at the opposite side from where the burners are entered, in this way giving the flame a complete circulation around the bowl.

The chief merit of this method of equipment is that it gives a long fire travel, not letting the flame and hot gases rush to the flue and out the chimney.

The installation is an experiment only and has not as yet been adopted by the Commercial department.

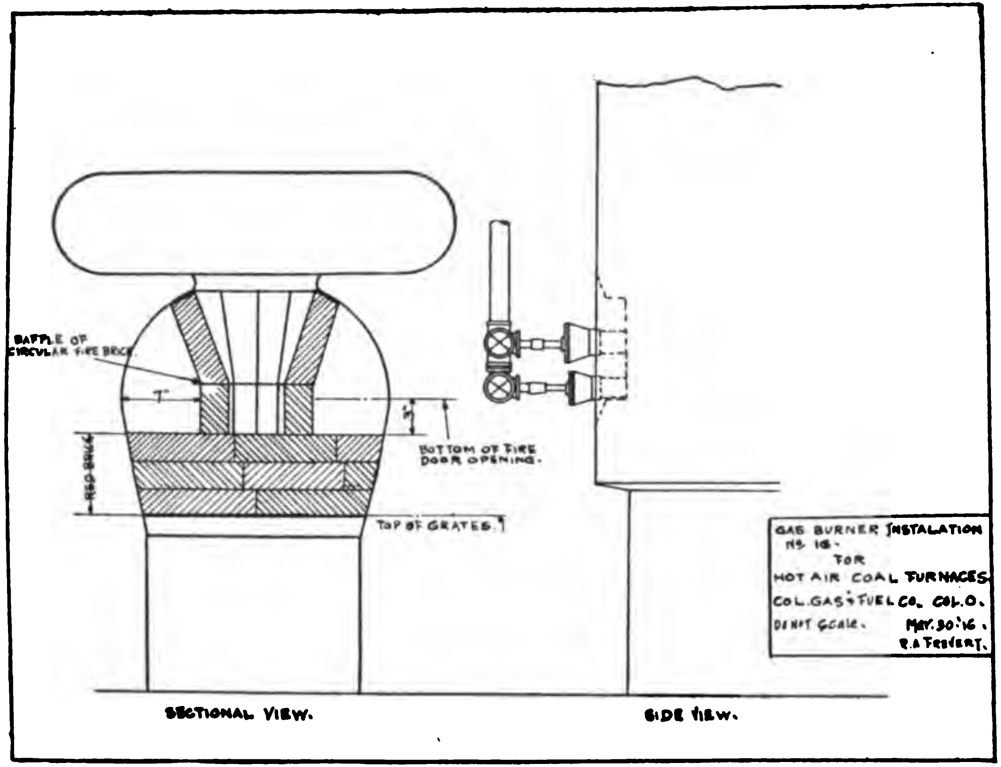
WRINKLE NO. 75.

HOW TWO REGULATORS MAY BE SET CLOSE TOGETHER.

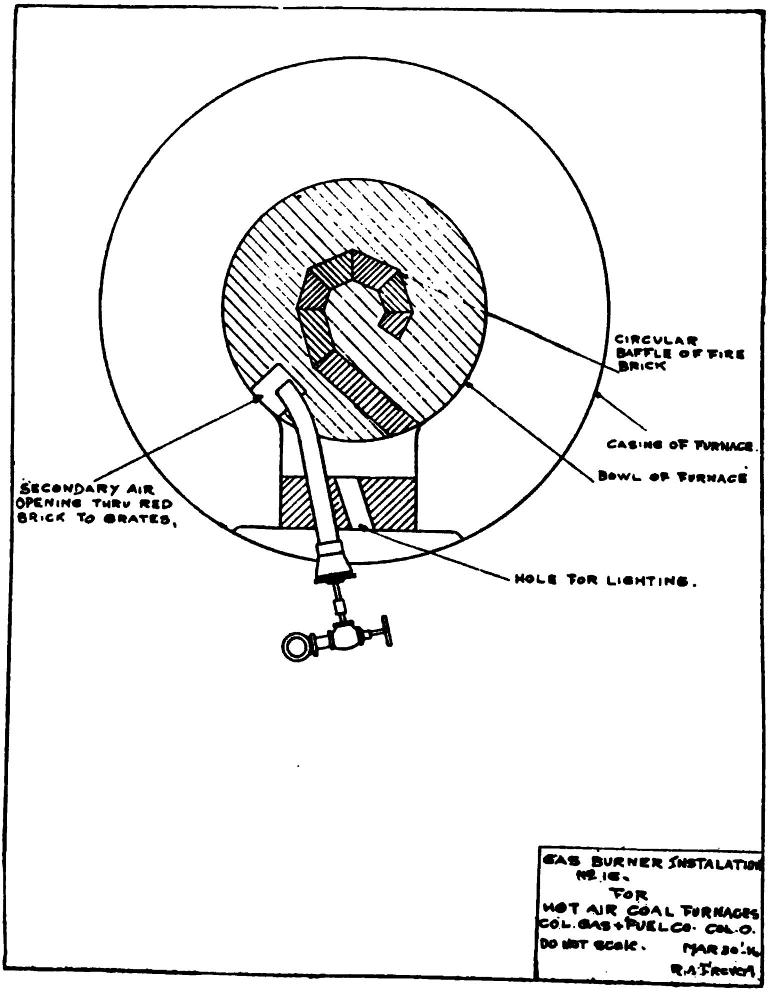
JAMES P. STRICKLER, SUPERINTENDENT, THE COLUMBUS GAS AND FUEL COMPANY, COLUMBUS, OHIO.

The accompanying sketch shows a very effective way to prevent the pumping of a regulator where it is necessary to place two of them tandem to reduce the pressure of from 250 to 300 lbs. to an intermediate working pressure of from 25 to 50 lbs.

By the use of a little appliance, which any fitter can make, the two regulators can be set in one building with only a few



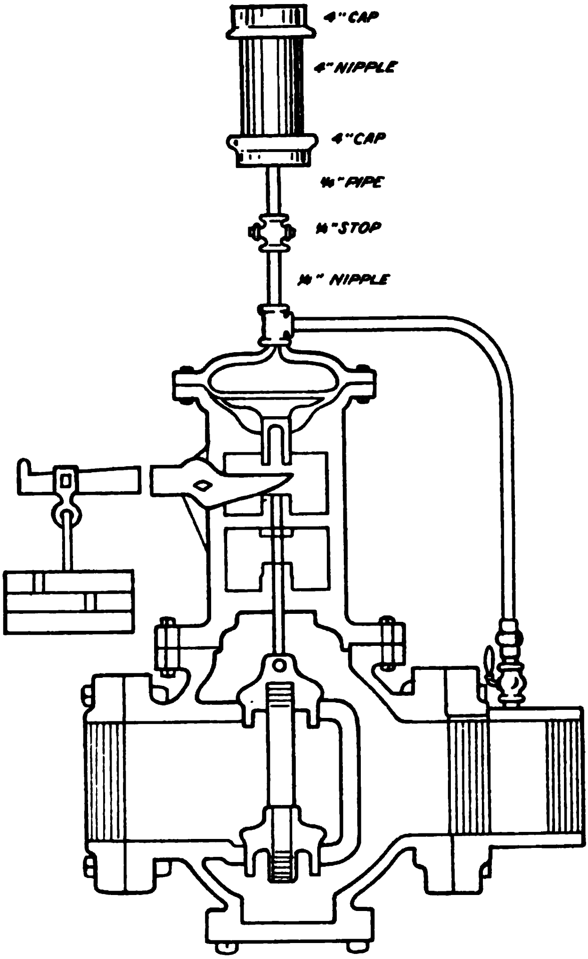
Wrinkle No. 74.



Wrinkle No. 74.

feet of pipe between them, thus saving an extra building and regulator sight for the same.

Take a piece of 4" pipe one foot long and two 4" caps, screw them together and drill one of the caps in the center with ¼" hole for pipe connection; take out ¼" plug on top of dia-



Wrinkle No. 75.

phram at equalizing pipe of regulator and connect the cushion tank with about one foot of ¼" pipe, putting ¼" stop in middle. The stop is used to structure the line to the cushion tank. This will stop the regulator from pumping and will give you a uniform pressure.

WRINKLE NO. 76.

SMALL FLAME TEST FOR GAS METERS.

F. W. STONE, MGR. THE ASHTABULA GAS COMPANY,
ASHTABULA, OHIO.

We have found in our meter shop that the work of giving meters the small flame test for registration on small consumption is greatly shortened by connecting a number of meters in a series, that is connecting the outlet of one meter into the inlet of another by means of a couple of ells, a nipple and a set of meter connections and making the test on the whole number at one time.

The meters may be set on the floor or the work bench. We have a special folding portable bench for the purpose. On the outlet of the last meter in the series is screwed a meter connection fitted with a pillar cock to reduce the flow of gas to any size opening desired.

The inlet of the first meter in the series is connected to the gas, the gas turned on and lighted at the pillar cock and the flame adjusted to the proper height for the small flame test.

All tops having previously been removed from the meters the position of the tangent on each meter is noted and marked if necessary on the edge of the meter case.

If the tangent of each meter makes one complete revolution in one hour with the flame at the pillar cock about ¾ of an inch in length the meter is O. K. as far as registration on small consumption is concerned; any meter that does not stand this test perfectly is taken off and adjustment made to correct same. Any number of meters up to say fifteen or eighteen can be tested at one time in this way.

WRINKLE NO. 77.

CLEANING PAINT FROM METERS.

F. W. STONE, MGR. THE ASHTABULA GAS COMPANY,
ASHTABULA, OHIO.

Make up a strong lye solution, using about one pound of Red Seal or Babbit's Lye to a pail of hot water. This water should be of a temperature of from 120 to 150 degrees. A sufficient quantity of the solution is put in a vat or tub and a box put in the center, the box projecting above the surface of the water about an inch so that the meter can be set on the box and still not be in the hot solution. The inlet and outlet of the meter are tightly capped. The meter is placed on the box and with a ladle the hot solution is poured on the meter running it down back into the vat. About five or six ladlefuls will soften the paint which can then be removed by a long handled fibre brush. After the sides and top of the meter are cleaned the meter is laid on its side and the bottom given the same treatment. The meter should be capped tight to avoid the possibility of any water getting down the inlet and outlet pipe. The brush we use is a long handled brush something similar to a bath brush. The meter does not get hot enough to do any damage. You can put your hand on at at any time and it is just warm. You will notice the meter is not dipped in the solution and the solution is not in contact with it long enough to make the meter hot. After being cleaned the meter is rinsed off with cold water. We can clean a ten light meter in this way in seven minutes. Every bit of the paint being taken off, the tin being as clean as when new. The lye has also the advantage of softening any rust so that it is also rubbed off leaving a good surface for a new coat of paint. We have given this a thorough trial and are very much pleased with the results.

WRINKLE NO. 78.

INK FOR METER ROUTE BOOKS.

F. W. Stone, Mgr. The Ashtabula Gas Company,
Ashtabula, Ohio.

During heavy rain the route books of the meter readers some time get wet causing the ink to run or blur. From experience we found that if the writing in the books was done with Signet ink this trouble would be eliminated.

WRINKLE NO. 79.

FORM FOR REGULATOR SCREENS.

F. W. STONE, MGR. THE ASHTABULA GAS COMPANY,
ASHTABULA, OHIO.

In making up the conical screen at the inlet side of regulators we find it an advantage to have made a wooden cone the size and shape of the screen desired. The wire screen is then formed over this wooden cone. This makes a better job and is made quicker. A set of cones consisting of one for each size will last for years.

WRINKLE NO. 80.

HOW TO COUNT YOUR CASH.

W. H. SCOTT, THE NORTHWESTERN NATURAL GAS CO.,
COMPANY, TOLEDO, OHIO.

I find when putting up currency in packages (and I am liable to being interrupted) by placing the bills face down on the first count, it makes me sure that I do not put up a package with only once counting it. Safety first!

WRINKLE NO. 81.

MAKING IT EASY TO TAKE THE MONEY.

W. H. SCOTT, THE NORTH-WESTERN NATURAL GAS CO.,
TOLEDO, OHIO.

A little talcum powder sprinkled at the Teller's window (especially on a damp day) will make the money much easier to handle and the Teller can do his work much quicker and easier. It is also convenient to sharpen your lead pencil on both ends; you will find this will save time and thought when rushed at the Teller's window.

WRINKLE NO. 82.

WHY OLD GAS WELLS SHOULD BE PUMPED.

F. G. Burson, The Manufacturers Light And Heat Co.,
Proctor, W. Va.

When a well is first drilled there is a smooth, hard wall and the packer will set and shut off almost any place and give good results. But after the first packer is pulled, and the well cleaned out, the wall above where the packer has been becomes soft, from the water standing on the packer, and it is hard to find a hard place to get the packer to hold. The wall below the packer has become honeycombed by the well being blown off so many times, and the packer is hard to shut off, I find the best and the cheapest way is to clean the well out and drill a pocket of about 50 ft. and then put the well to pumping with a good gas engine, using a wire line, and you get all the gas that is coming out of the sand without any waste by blowing. This is my experience in the Proctor, W. Va., field.

WRINKLE NO. 83.

USE WATER TO WORK PACKER LOOSE.

M. J. Cummings, Dist. Foreman, Manufacturers Light and
Heat Company, Cameron, W. Va.

When tubing new gas wells, that have quite a volume of gas, and blow sand, etc., up in walls of the different sands, especially the Big Injun sand — as it is generally wet — and this sand, etc., blowing up on walls causes your packer to stick and sometimes set.

Just put in a quantity of water in your 6⅝″ casing, giving time for water to get down to packer; then work packer up and down hole a few times, giving time for water to get by packer which will wash down walls of hole. Then packer will follow down nicely.

If packer sticks any more, apply more water as before. I find that this wrinkle saves rubber on packer and oftentimes a pulling job.

WRINKLE NO. 84.

METHOD FOR REPAIRING LEAK IN BEND.

W. J. CUMMINS, AGENT, THE MANUFACTURERS LIGHT & HEAT COMPANY, CAMERON, W. VA.

In making fire bends in laying pipe lines, the joint will sometimes buckle and cause a crack in the pipe. A leak of this nature can be repaired with a saddle, if saddle is first placed on joint where buckled (marking exact location of saddle with center punch marks) close sides and ends with potter's clay, then pour melted lead through opening in top of saddle until the inside space is filled; after lead cools, remove saddle and place gasket on pipe, replace saddle which now will conform with the irregular surface of the pipe and make a right joint. A crack in an over bend can be repaired in like manner.

This method will save the expense of removing defective joint; defects of this nature are often not discovered until test is made, which makes the expense greater.,

WRINKLE NO. 85.

A COMPLETE WELL RECORD FORM.

S. W. MEALS, DIVISION SUPT., CARNEGIE NATURAL GAS CO., MOUNDSVILLE, W. VA.

1st. I am showing a blank copy of a Well Record Form I have used for years, which I could not well do without. Note we carry our Transfers to the well on the back of the Record, which also takes care of the Credits from the well. We are able by this to keep a complete record of our casing, etc., at the well, in the well and taken from the well.

(FRONT)

CARNEGIE NATURAL GAS COMPANY

Map Sheet No........... RECORD OF WELL Well No...........

Drilled on Farm of Acres, situate in

Township County Lease No.

District

Shipping Point Foreman

RIG WELL

Located	Commenced Drilling
Notified Gen'l Office	Notified Gen'l Office
Commenced	Completed Drilling
Completed	Notified Gen'l Office
Contractor	Contractor
Address	Address

ROCK FORMATION	Top	Bottom	REMARKS	Pressure and Volume	
Conductor				½ Minute	Lbs.
Mapleton Coal				1 “	“
Pittsburgh Coal				2 “	“
Little Dunkard				3 “	“
Big Dunkard				4 “	“
Gas Sand				5 “	“
1st Salt Sand				10 “	“
2d Salt Sand				15 “	“
Maxton Sand				30 “	“
Little Lime				1 Hour	“
Pencil Cave				Rock	“
Big Lime				{ Tubing	Inch
Big Injun				Size of { Casing	“
Gantz Sand				Vol. by Water	
50 Foot Sand				“ “ Mercury	
30 Foot Sand				“ “ Pressure	
Gordon Stray					
Gordon Sand				CONNECTED TO MAIN LINE	
4th Sand					
5th Sand				Length of Line	Feet
Bayard Sand				Size of Line	Inch
Elizabeth				DISCONNECTED FROM LINE	
Speechley					
Bradford				Notified Lessor	
				Abandoned	
				Repacked	
				With Feet	Tubing

Total Depth Feet at $ per Foot $

Gas Furnished at Cents per Foot

CASING RECORD

Size	Charged to Well		Put in Well		Pulled		Left in Well		Transferred		Left at Well		PACKER
	Feet	In.	Feet	In.	Feet	In.	Feet	In.	Feet	In.	Feet	In.	
													Kind
													Size
													Set at Feet
													WELL SHOT
													By
													With Qts. at Feet

Casing Cemented in Well....................by....................Company Employee

(Size: 9½ x 14 in.)

Wrinkle No. 85.

(BACK)
180MM1113

RECORD OF MATERIAL USED AT WELL

No......on................Farm in................ Township / District ....County,..........

DATE	BROUGHT FROM	Feet	In.	Date	TAKEN TO	Feet	In.	
		RIG						
		10" CASING						
		8¼" CASING						
		6⅝" CASING						
		5" CASING						
		" TUBING						
		BRANCH LINE CONNECTING WELL						
		MISCELLANEOUS						

Wrinkle No. 85.

WRINKLE NO. 86.

NEW STUNTS WITH DYNAMITE.

S. W. MEALS, DIVISION SUPERINTENDENT, CARNEGIE NATURAL GAS CO., MOUNDSVILLE, W. VA.

Speaking of slips on our line, we have been able to prevent slips from moving farther at times by using dynamite. Boring holes at the upper side of a slip, down through the hard pan and shooting it, which allows the water to get away.

Speaking of dynamite, brings to my mind another use we make of it. By using an old Measuring Line Reel and some Torpedo wire, we have some small buckets made for the different size casing. By fastening wire to opposite sides, and by measuring down to proper depth, we pull up and find a coupling in this way. First having placed a couple of sticks of dynamite in the bucket. We then load a part of a stick with time fuse and drop it, which lodges in our bucket. In this way we shoot off casing, when we are unable to pull it. This saves the cost of running casing cutters, splitters or having a Torpedo Company send out a small shot, which at this time requires a large fee. We have been able also in this way to help gas wells, by using a larger quantity of dynamite. But for casing, I would much prefer the dynamite, than any other method I have ever tried, and any Rouster can do the work.

WRINKLE NO. 87.

SEND GAS CARD WITH CHECK.

M. A. MICKLEY, THE MARION GAS CO., MARION, OHIO.

We had a good many of our consumers send in checks for their bills, but would not send their gas card along; this would necessitate looking up their accounts. I had printed at the place where stub is cut off on card "Send this stub when mailing check", since then in nearly every case the stub comes along with the check.

WRINKLE NO. 88.

AN AUTOMATIC ENGINE JACK.

D. Roesch, Armour Institute of Technology, Chicago, Ill.

Anyone who has ever had occasion to pry over an engine with a heavy fly wheel will readily recognize the great labor-saving properties of the following described device:

At the plant with which the writer was connected, there is a 14-ton fly-wheel on a single crank tandem single-acting gas engine which once a day at least must be set to the proper position for starting. As the air starting equipment of this engine was arranged to give air to the rear cylinder only once every two

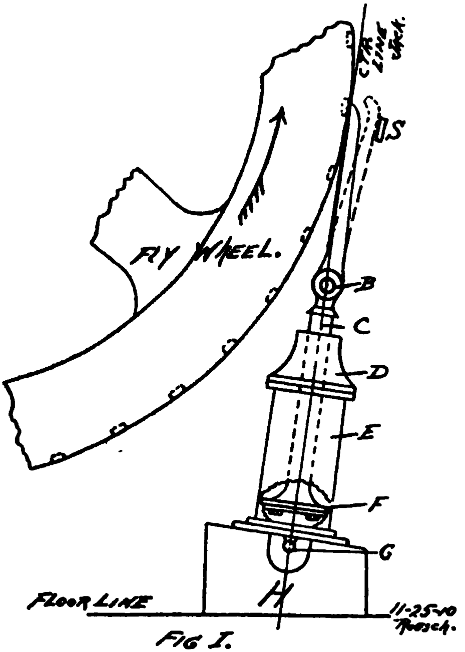


FIG I.
Automatic Engine Jack. Outline.

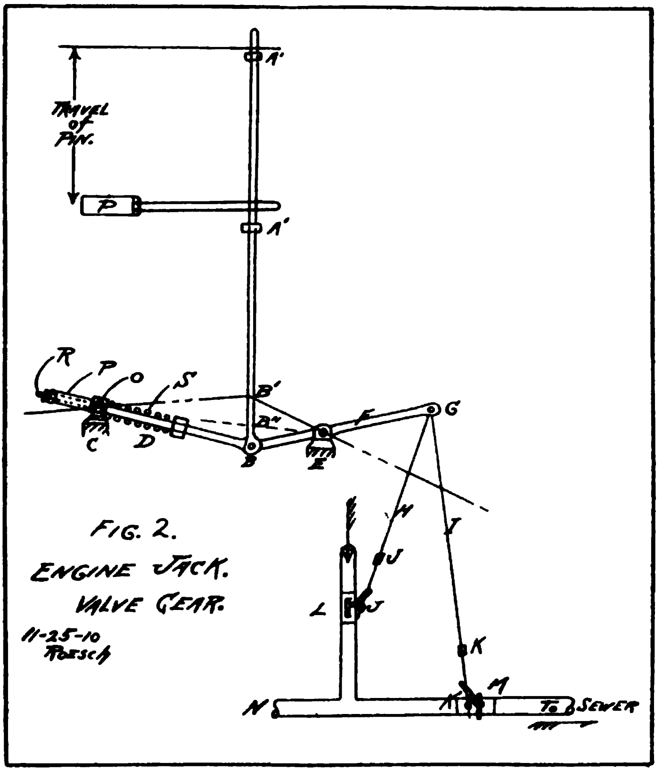
Wrinkle No. 88.

revolutions, on the rear piston's expansion stroke; it will be seen that under certain conditions the wheel would have to be moved a full revolution, forward or backward, or nearly two revolutions if capable of being moved in one direction only. For this purpose two jacking levers with fulcrums were provided so that the wheel could be moved either backward or forward. The lever for moving the wheel forward was in a particularly bad place because of exhaust and water pipes and a platform which supported the fulcrum for this lever. It was necessary to have two men on a ten-foot bar to jack this engine forward when the unbalanced crank was coming up. After some months of this kind of work and the constant repairing of the platform and bars, the following device was invented and put in operation. This has worked for the past six months with no attention despite the fact that the apparatus was made with the exception of two pieces, out of old material found around the power house.

The photograph shows the section of the 12-foot fly-wheel, the jack cylinder, the lower portion of the push arm which engages with the notches in the wheel, the valve gear which automatically reverses the motion of the piston and push arm, the inlet and discharge valves, and the lower end of a four-inch air chamber used to reduce the water hammer when the jack reverses at the upper end of the stroke.

Fig. 1 is an outline of the cylinder, piston and push arm. A is the push arm the lower end of which is forked and has a pin B about which it can swing as indicated by the dotted outline of the arm. S is a stop provided so that when the water is turned on, the jack will operate without interfering with anything; until jacking is started by pressing the free end of the push arm lightly into the fly-wheel notch at the bottom of the stroke. The pressure from the jack will then keep it in place until the top of the stroke is reached when the push arm falls to the dotted position against the stop S. This prevents the corners of the notches or the face of the wheel being marred. C is the piston rod rigidly connected to the piston F shown through the part broken away from the cylinder E.

G is a 2-inch street ell screwed into the center of a plate



Wrinkle No. 88.

1 inch thick that forms the bottom head of the cylinder and through which four ⅝-inch foundation bolts pass. H is a concrete base built with a trough through which the pipe from G can extend into the open.

Fig. 2 shows the diagrammatic outline of the valve gear which corresponds to the piston in its lower position and ready to start up.

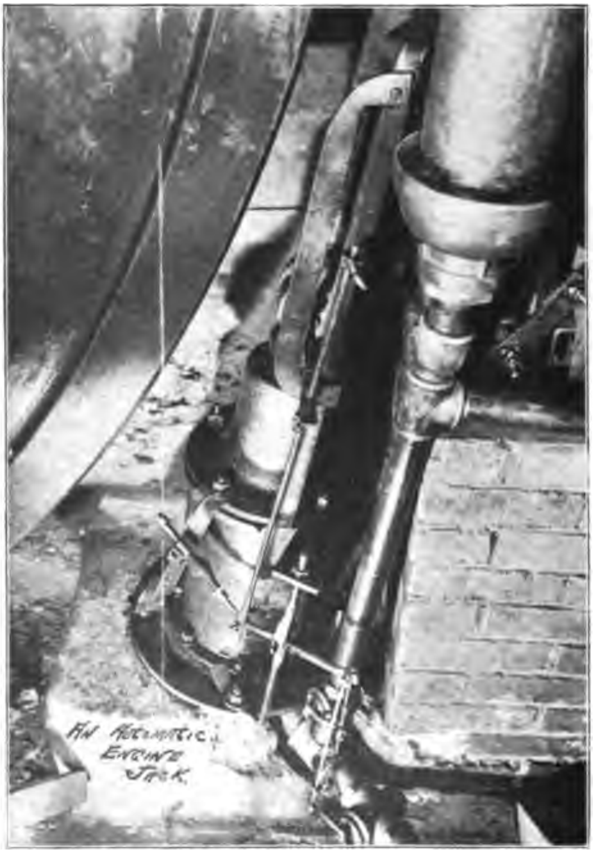
Pin P Fig. 2 corresponds to B Fig. 1 and has an extension with an hole; through which a rod passes carrying the two tappets A and A′. This rod is linked to the rocking levers D and F; forming a toggle joint which is the basis for operating the valves. Assuming the piston to be moving upwards; the extension of pin F will strike tappet A′ and cause Pin B to raise to B″. When B passes the center line between fulcrums C and E it will snap to B′ which motion closes the inlet and opens the discharge valves of the cylinder. On the downward motion of the piston, the toggle hinge is at B′ and when extension of pin P moves tappet A down; the toggle hinge will move to a position B″ and snap over: again reversing the inlet and discharge valves causing the piston to start up on the beginning of a second cycle.

The throw of B is limited by the collar P on the extension of lever R and can be adjusted by the lock nuts shown. The spring S is in compression and is adjusted in strength by the collar and set screw shown on its right-hand end. The motion at B is transferred through the lever F with fulcrum at E, to G which actuates rods H and I. These two rods each have two tappets as shown at J and J′ and K and K″ respectively, which operate the inlet valve L and the discharge valve M. L is a common ½-inch gas cock and M a 2-inch gas cock. To a hole in the head of each is fitted a lever about five inches long bent at an angle of 45 degrees to the axis of the head. These levers have a slotted hole as indicated, to permit the rods H and I but not the tappets J, J′, K and K′ to pass through. The pipe at N connects as directly as possible to the cylinder.

By adjusting the positions of the tappets J′, J, K′ and K the amount of opening and the lap when closed of the inlet and discharge valves can be regulated. The speed also to a certain extent can be regulated with these tappets.

By means of the tappets A and A′ the stroke of the piston and the push arm can be adjusted. In the jack as used the notches in the wheel are seven inches apart and the stroke of the piston is set one inch more than this. This allows plenty of time for the push arm finger to be inserted in the fly-wheel notch. Ordinarily the speed is regulated by throttling on the main valve leading to the jack; slow speed being especially advantageous in checking valve settings, joints of ignition and conditions of a like nature.

The cylinder is made from a discarded 8-inch air brake cylinder with the usual piston fitted with cup leather packing and follower plate. The jack as installed uses city water pressure at from 30 to 50 pounds per square inch pressure and to reduce water hammer when the inlet valve closes, an air chamber is provided made of a piece of 4-inch pipe about four feet long. Air pressure was also experimented with with air taken from the storage tanks provided for starting the engines. With air as a medium for actuating the jack much smaller valves would need to be provided at least at the inlet valve and there is the somewhat objectional feature of the spring of the air causing the jack to overtravel. However, with proper changes and ad-



Wrinkle No. 88.

justments compressed air can very satisfactorily be used. The jack could also be operated with steam under practically the same conditions as air operated and would prove a valuable device in many gas steam and refrigerating plants.

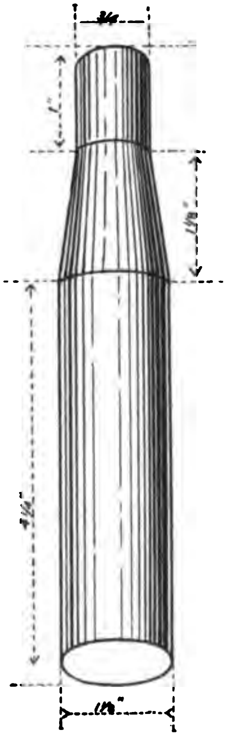
WRINKLE NO. 89.

METER CONNECTION WITHOUT SOLDERING COPPERS.

W. C. Carey, Foreman Meter Repairs, Iroquois Natural Gas Company, Buffalo, New York.

The drawings show a very strong, quickly made meter connection that can be made without the use of soldering coppers.

SWEDGE FOR 10 LT.
METER SWIVEL.



Wrinkle No. 89.

I use less than 1/8 of an ounce or perhaps 1/16 of an ounce for a light meter connection joint. I use a small soldering pot — 5″ in diameter is large enough and tool taper to the taper of swivel. Then swedge out the lead pipe to the depth required.

Have the solder in pot hot enough to tin the swivel, dip the edge of lead pipe into the hot solder to tin the edge of the pipe. Then dip the swivel into the solder, hold it until the swivel gets hot and then quickly thrust it into the pipe.

WRINKLE NO. 90.

SELLING GAS LIGHTS.

ALAN LEAMY, MANAGER WELSBACH CO., COLUMBUS, OHIO.

Put on a Gas Lighting Campaign. If you can not put on a big one start a small one. It will grow.

If you can not put on solicitors start an *Advertising* Lighting Campaign. Run a few good-sized Ads. in the daily papers, sell standard light, give a three months' guarantee with each light and collect with next three gas bills.

Ask yourself this question: "If I were a consumer and had a new Gas Range or a Gas Furnace and poor cheap lights, would I be inclined to praise the gas service or condemn it?" The Gas Service is condemned when the lights are poor.

Ask yourself this question: "If I were a consumer would I think the Gas Service was good if I used cheap, carbonized, trouble-making lights as I would if my house was ablaze with perfectly operating high-grade Lights?"

Gas service is good only when burned in good appliances.

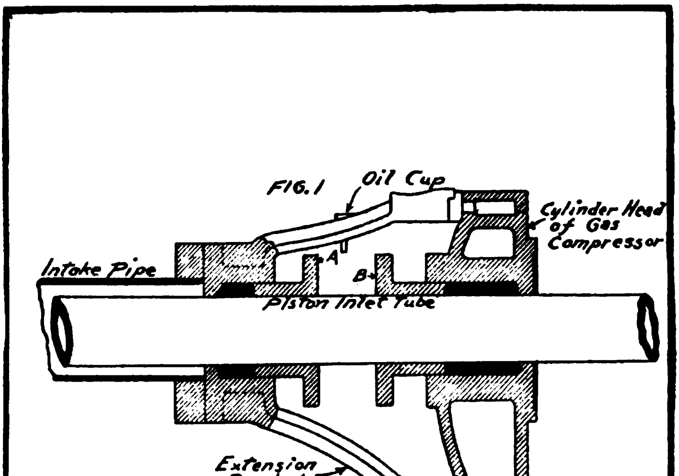
WRINKLE NO. 91.

TO KEEP THE STUFFING BOXES TIGHT.

MARTIN A. THIEL, CHIEF ENGINEER GAS ENGINE DEPARTMENT,
THE C. & G. COOPER COMPANY, MT. VERNON, OHIO.

Yours of Feb. 28th received and as you are asking for Wrinkles that will help the natural gas men, I looked through our sketches of my schemes recently introduced in some of the Gas Compressor Stations, and picked out G 9-296 which I thought might be of interest to many station operators that are using Hurricane Piston Inlet Tube Compressors and have had difficulty in keeping their stuffing boxes on the same tight enough to keep them from blowing gas into the room.

Fig. 1 on drawing attached, shows the standard construction with stuffing box gland A, packing the intake pressure



Wrinkle No. 91.

against the atmosphere and gland B, packing it against the delivery pressure. Both soft packings in these stuffing boxes touch the piston inlet tube which when set up to keep them tight cause loss of power through excessive friction and a loss in gas when either of them is allowed to become leaky, both of these troubles occur quite frequently.

Fig. 2 shows stuffing box gland C, with a gas-tight extension sleeve D, passing through gland E, in a manner that the rear packing touches the sleeve only, leaving the piston inlet tube free to do its work with less than half the friction, because but one packing touches it now instead of two, with another advantage that of packing only the difference in pressure between the discharge and suction.

The possibilities of this scheme can easily be seen when one considers that no gas can enter the room even should the cylinder head end packing leak around the tube, the gas will be returned to the intake pipe instead of flowing into the room. Two connection straddle of the center in gland flange from a force feed oiling system assures lubrication on both sides of the tube which preserves the packing, reduces the care and wear so troublesome in the earlier construction of this tube packing.

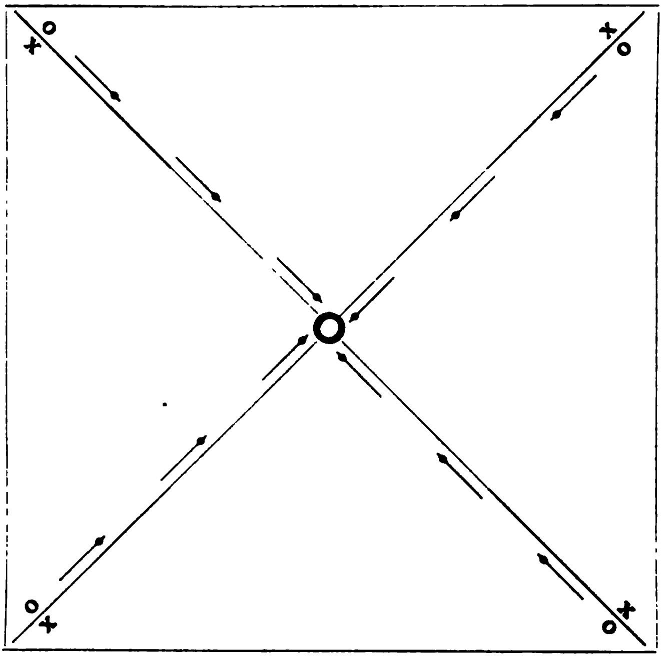
WRINKLE NO. 92.

HOW TO MAKE PROPELLER TO RUN METER MECHANISM.

Geo. Fox, Columbia Gas & Electric Co., Branchland, W. Va.

I find very often an index case for a meter becomes rusty or the screws so badly rusted that one can hardly get in to the hands of a low pressure meter or even the hands are very tedious to get off and on again and be the proper reading as you would have it to register, and very often one wants to run the index up or back to a certain reading and to avoid the labor and save the time I devised a very simple scheme, which I hope will be of use to some one reading the Wrinkles of our association.

As the mechanism is very sensitive in the index and does not require very much power to run the hands either forward or backward, after you have the index case off the meter attach the following: Get a piece of paper 9" x 9" and cut each corner toward the center leaving space in the center to fold the ends to the center in the shape of a propeller on a motor boat, and with a nail placed from the inside of the small shaft that operates the index hands; this done, then place a cork for a washer on the nail so the nail will not turn instead of the propeller; then place the paper propeller on properly fixed in the shape mentioned and then another cork to keep the propeller from slipping around the nail, and you have a power with the help of a small breeze to operate the hangs; by reversing the wings on the paper you will be able to run either forward or backward, as you wish your meter to register.



To reverse the propellers use leaves as plan suggests only use ones marked X to center. One should use pretty stiff paper so as not to bend too easily.

Wrinkle No. 92.

If this information is not explicit enough, I am ready to answer any questions anyone interested may ask pertaining to this Wrinkle.

WRINKLE NO. 93.

SCREEN TO KEEP OUT INSECTS' NESTS.

HARRY T. EGBERT, AGENT, UNITED NATURAL GAS COMPANY,
OIL CITY, PA.

I submit the following: At the outlet end of blow-off pipe from either regulator or safety tank (if the latter is installed), a street ell or open return bend is screwed, to keep moisture from entering pipe.

Very often during the summer the open end of these fittings is entirely plugged by the mud nests of various insects, to the detriment of the equipment.

This can be avoided, by neatly soldering a fine mesh brass or copper screening over the end of the outlet fitting, thus keeping the opening clear at all times.

I trust that this simple but effective contrivance may be of help to others.

WRINKLE NO. 94.

DRIPPING PAN BENCH.

JOS. P. DELANEY, UNION GAS & ELECTRIC COMPANY,
CINCINNATI, OHIO.

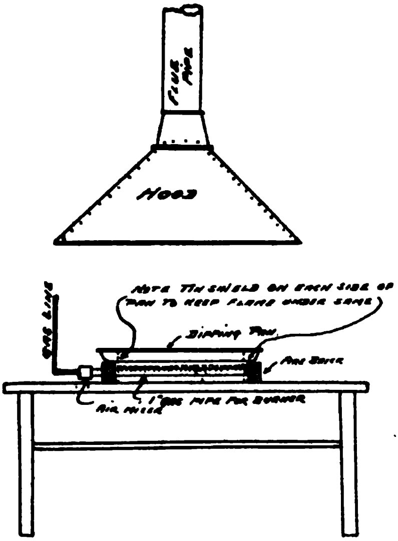
A dipping pan and bench for tinning backs and fronts, also back plates and disks of tin meters. Can be used for tinning meter swivels. The pan is half filled with molten solder and a small piece rosin put in pan which acts as a flux. The back or front is simply dipped in the solder and then wiped off. The edge is tinned perfectly and a great deal of time is saved. The hood simply carries the fumes away.

WRINKLE NO. 95.

WATER TANK FOR GAS CALORIMETER.

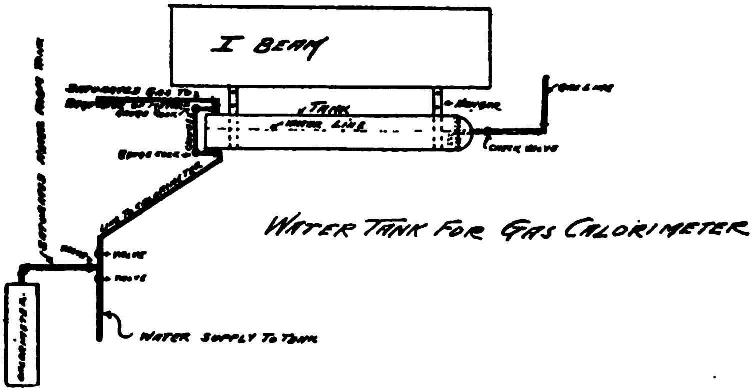
JOS. P. DELANEY, UNION GAS & ELECTRIC COMPANY,
CINCINNATI, OHIO.

Overhead water tank for gas calorimeter to insure a constant head of water to the calorimeter while making a test for B. T. U. of the gas. The gas connection is made as shown in sketch, the gas enters tank at one end and dips down into the water, in that way saturating both gas and water. The gauge glass at end of the tank indicates the height of water at all times.



Dipping Pan Bench.

Wrinkle No. 94.



Water Tank for Gas Calorimeter

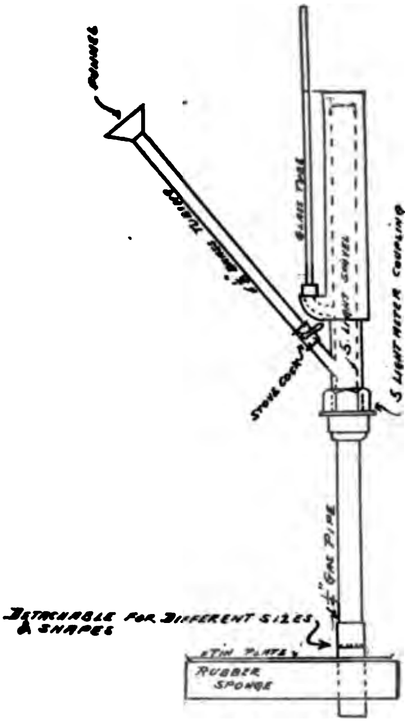
Wrinkle No. 95.

WRINKLE NO. 96.

PORTABLE TESTING GAUGE.

Jos. P. Delaney, Union Gas & Electric Company,
Cincinnati, Ohio.

A portable testing gauge for testing the different ports and channels or diaphrams of gas meters. This gauge can be made up from the old material that is always found around the gas company shops.



PORTABLE TESTING GAUGE

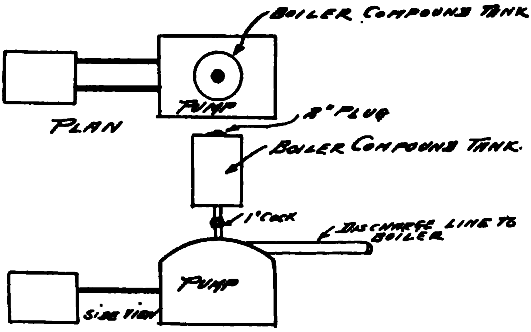
Wrinkle No. 96.

WRINKLE NO. 97.

FEEDING BOILER COMPOUND, WITH DUPLEX PUMP THROUGH AIR CHAMBER.

Jos. P. Delaney, Union Gas & Electric Company,
Cincinnati, Ohio.

Feeding boiler compound with duplex pump through air chamber. The air chamber is a piece of 6" screw pipe with a cap on each end, one tapped 1" and the other 2". This is connected as shown in sketch, to fill with compound, shut off the 1" stop and take the 2" plug out, then reverse the operations, the water surging through the pump will always carry some of the compound to the boiler. This can be regulated by the 1" stop cock.



Feeding Boiler Compound With Duplex Pump Through Air Chamber

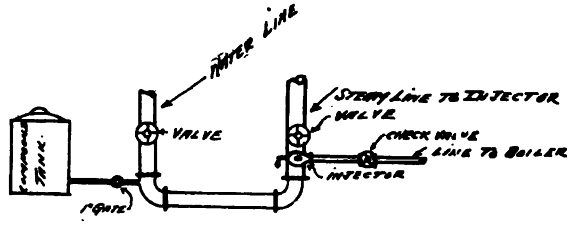
Wrinkle No. 97.

WRINKLE NO. 98.

FEEDING BOILER COMPOUND WITH INJECTOR.

Jos. P. Delaney, Union Gas & Electric Company,
Cincinnati, Ohio.

The sketch will explain how this works. Care must be taken so that you will not turn the water on too much as this would allow the water pressure to blow the compound out of the tank.



Feeding Boiler Compound With Injector.

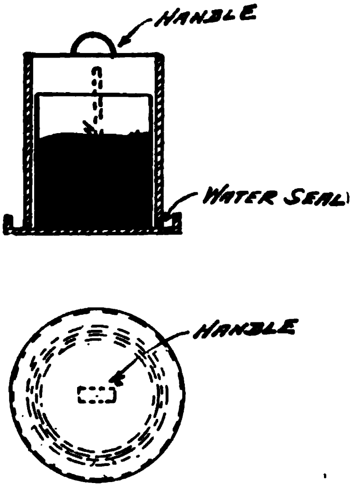
Wrinkle No. 98.

WRINKLE NO. 99.

GASOLINE CAN.

Jos. P. Delaney, Union Gas & Electric Company,
Cincinnati, Ohio.

A gasoline shellac or alcohol can to prevent the evaporation of gasoline or alcohol and to prevent the hardening of the shellac. The cut will show the construction.



Gasoline Can.

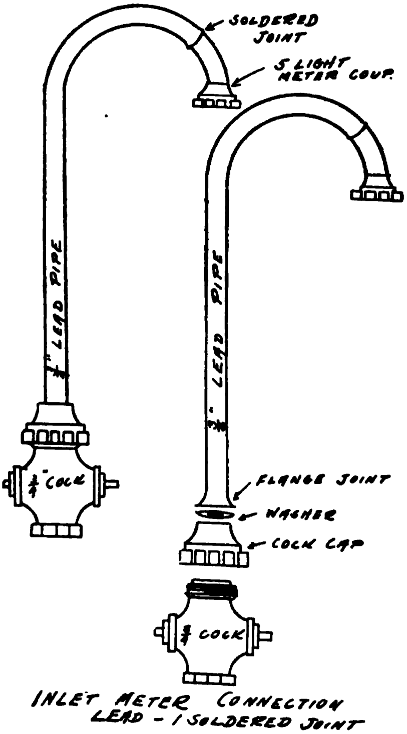
Wrinkle No. 99.

WRINKLE NO. 100.

INLET METER CONNECTION.

Jos. P. Delaney, Union Gas & Electric Company,
Cincinnati, Ohio.

A lead meter connection with one soldered and one flanged joint. The sketch will show the details.



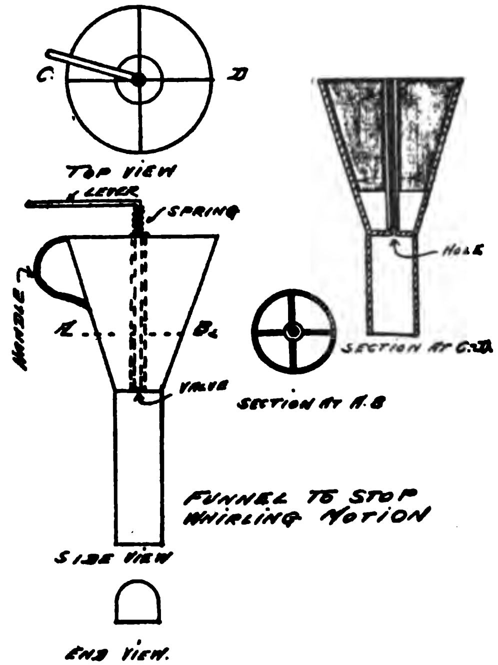
Wrinkle No. 100.

WRINKLE NO. 101.

FUNNEL TO STOP WHIRLING LIQUID.

Jos. P. Delaney, Union Gas & Electric Company,
Cincinnati, Ohio.

A handy funnel to have around the shop is shown in cut. This funnel is divided into four divisions near the top and these divisions reach nearly to the bottom of the upper part of the funnel. This funnel will stop the swirling motion of any liquid that you may be pouring into the funnel.



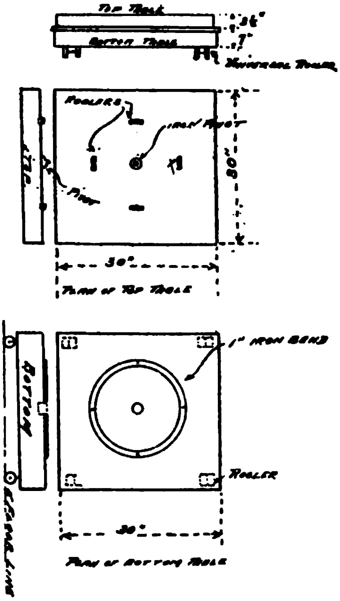
Wrinkle No. 101.

WRINKLE NO. 102.

REVOLVING TABLE FOR LARGE METERS.

Jos. P. Delaney, Union Gas & Electric Company,
Cincinnati, Ohio.

This sketch shows a revolving table which after a meter or regulator is placed on it the lower part can be locked and the upper part moved in any position desired, also the lower and upper tables can both be moved to any position, making it easy for one man to handle meters or regulators of large type.



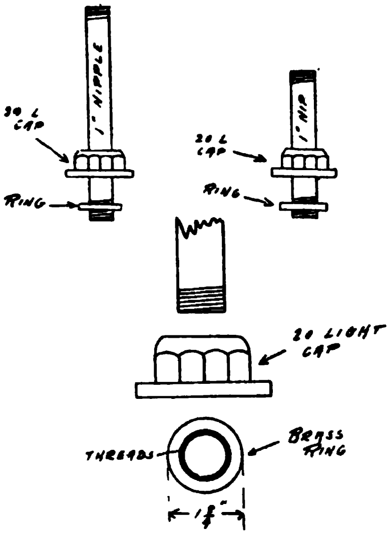
Revolving Table for Large Meters
Wrinkle No. 102.

WRINKLE NO. 103.

EXTENSIBLE SWIVEL.

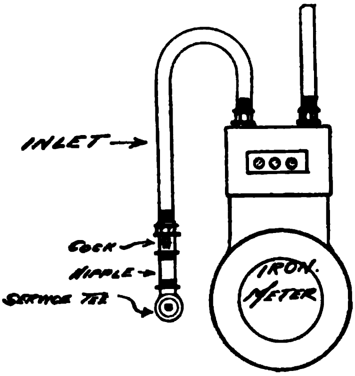
Jos. P. Delaney, Union Gas & Electric Company,
Cincinnati, Ohio.

This cut shows an extensible swivel for gas meters, also a pipe bend for connecting the inlet of meter, the bend is made of steel pipe and is much cheaper than pipe fittings, makes a very neat appearance. The cut will show how the extensible swivel is made.



EXTENSIBLE SWIVEL

Wrinkle No. 103.



SPECIAL CONNECTION.

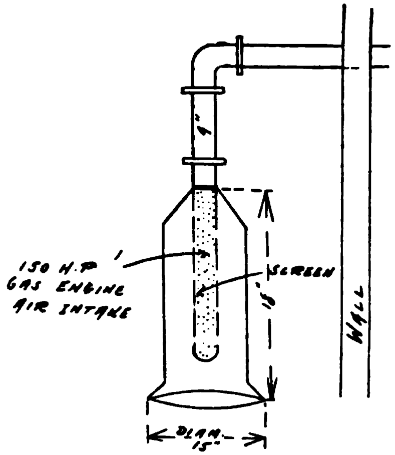
Wrinkle No. 103.

WRINKLE NO. 104.

AIR INTAKE SHIELD AND EXPLOSION MUFFLER.

Jos. P. Delaney, Union Gas & Electric Company,
Cincinnati, Ohio.

Air intake shield and premature explosion muffler for gas engines. The device will positively muffle any explosion in the intake pipe and shield will protect intake from rain or snow.



AIR INTAKE SHIELD AND
PREMATURE EXPLOSION
MUFFLER

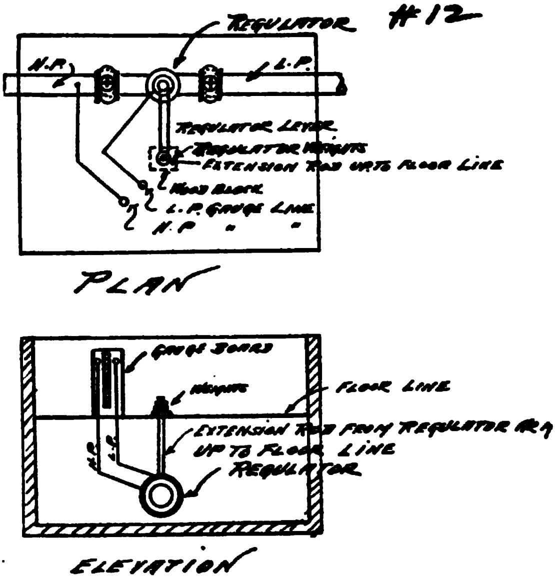
Wrinkle No. 104.

WRINKLE NO. 105.

REGULATOR WITH EXTENSION AND SAFETY DEVICE.

Jos. P. Delaney, Union Gas & Electric Company,
Cincinnati, Ohio.

This cut shows a regulator with an extension rod to the floor above. This saves the regulator man many a trip to the basement to regulate his pressures. We also have a wooden block directly beneath the weighted lever; this block comes within two inches of the lever when regulator is feeding. The idea of the block is this: that if the equalizing pipe broke the regulator could not open wide and allow the high pressure gas to reach the low pressure line.



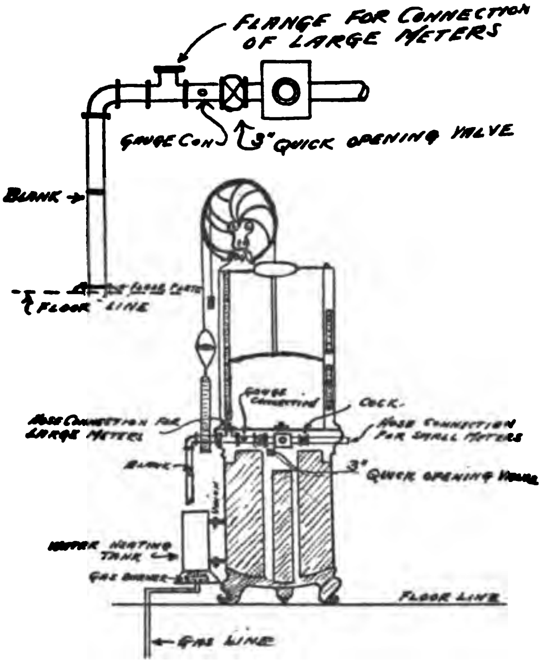
Wrinkle No. 105.

WRINKLE NO. 106.

NEW ATTACHMENTS ON METER PROVER.

JOS. P. DELANEY, UNION GAS & ELECTRIC COMPANY,
CINCINNATI, OHIO.

The Meter Prover in sketch shows a small tank connected on side of Prover. There is a small gas burner under the tank which heats the water in the Prover and it takes very few minutes to bring temperatures together for testing purposes. Upper cut shows connections for testing large positive meters; attached to flange are an ell and nipple with a 3″ I D rubber hose about 4′ long and 300 lt. coupling on other end. This arrangement allows you to test any positive meter up to its capacity.



METER PROVER & NEW ATTATCHMENTS ON SAME

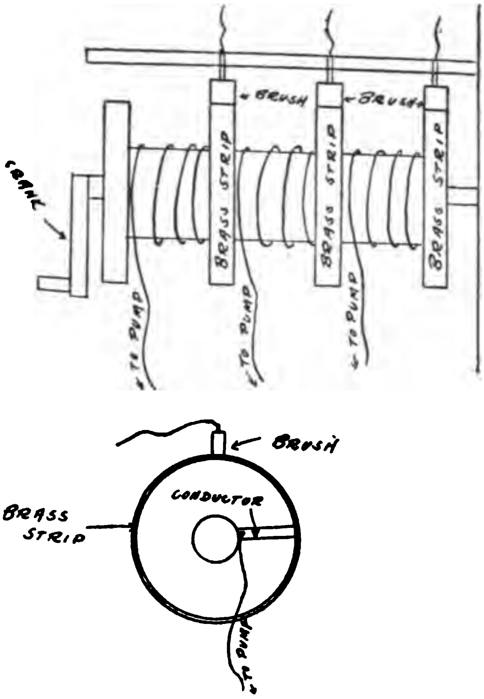
Wrinkle No. 106.

WRINKLE NO. 107.

REEL FOR WIRE FOR MOVABLE PUMP.

Jos. P. Delaney, Union Gas & Electric Company, Cincinnati, Ohio.

This cut shows a reel which we made to save us the trouble of connecting and disconnecting the wires on our 3-phase 440 volt A. C. motor which is direct connected to our centrifugal pump. The river stage here varies from 9 feet to 50 feet and as the river rises we wind the wire up or if it lowers we unwind. The cut will show the construction of this wheel.



REEL FOR WIRE FOR MOVABLE PUMP

Wrinkle No. 107.

WRINKLE NO. 108.

LEAVE THE METER, BUT CUT OFF GAS.

L. S. MAYER, AUDITOR, THE LOUISVILLE GAS & ELECTRIC CO., LOUISVILLE, KY.

For one year this company has tried out the experiment of reducing cost of meter changes and giving quicker service by leaving all meters in — cutting them off at the street or at the meter, and cutting them off at the meter and putting back on by men on bicycles who take applications, collect bills, etc. The cost is about nine cents each cut-off or cut-on compared with seventy-five cents for meter truck.

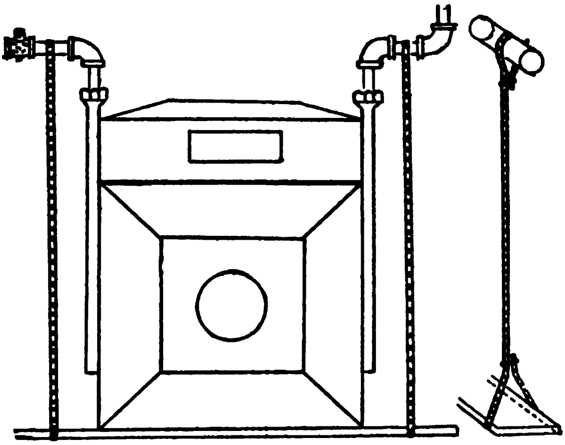
Where profits are small, as in gas business, companies will find this a good thing.

WRINKLE NO. 109.

METHOD OF HANGING TIN METERS.

CHARLES DE WEESE, GAS INSPECTOR, LOUISVILLE GAS & ELECTRIC COMPANY, LOUISVILLE, KY.

I am showing a drawing of a method of hanging large tin gas meters which I have found to be a good one, especially so where meter and pipes are subjected to vibration because of the fact that every motion of the meter conforms to that of the pipes, thereby eliminating loosening of swivels, or breaking of standpipes.



Wrinkle No. 109.

This method will also be found to be more economical of construction than the ordinary stationary shelf, especially where brick, stone, or tile walls are to be drilled. See that pipes are securely fastened to joists.

WRINKLE NO. 110.

TO OBTAIN A HIGH TEMPERATURE BLAST FLAME WITH AN OPEN BUNSEN TUBE BURNER, AND PREVENT SAME FROM BLOWING OUT.

E. D. Ivory, Industrial Department, The People's Natural Gas Company, Pittsburgh, Pa.

Cut male thread on outlet end of tube, and screw on, loosely, a standard reducing socket, one size reduction, as indicated in Fig. No. 1, then adjust the gas and air to the blast capacity of the tube. No screens, baffles, grids, perforated disks, or pilot lights will be found necessary as the expansion obtained by the use of the reducer equalizes the rate of flame propagation, and the velocity of flow of the mixture of gas and air, thus localizing combustion at the mouth of the tube.

The same result may be obtained by constricting the end of the tube sufficiently, that a straight socket, screwed on loosely, as in Fig. No. 2, will give the necessary expansion.

This latter method will reduce the capacity of the burner slightly but produces a more concentrated flame. Both of these burners dispense with the long, cold, hollow cone usually produced by a Bunsen Tube; it may be constructed so that even with a pressure of 20 inches water, it may be swung rapidly from side to side, or up and down without blowing out; the combustion is more self-supporting than with ordinary tube burners and can therefore be held in closer confinement.

WRINKLE NO. 111.

A PORTABLE TEST GAUGE.

T. H. Kerr, Engineer, The Ohio Fuel Supply Company, Columbus, Ohio.

The test gauge shown in the accompanying cut was designed by the writer as a portable test gauge to serve the same functions as a one hundred inch water column for the purpose of calibrating differential pressure gauges used in connection with orifice measuring apparatus. The gauge consists of a glass bulb having

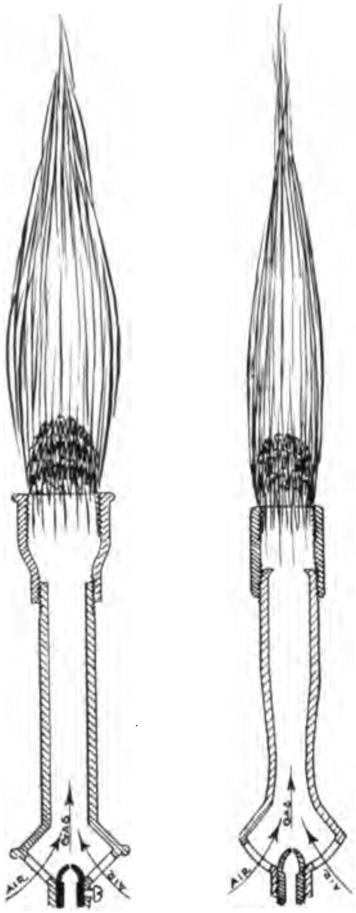
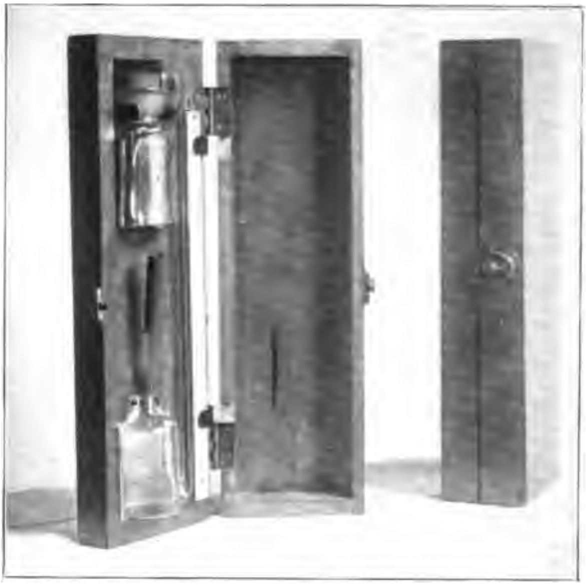


FIG. 1 FIG. 2.

Wrinkle No. 110.



Wrinkle No. 111.

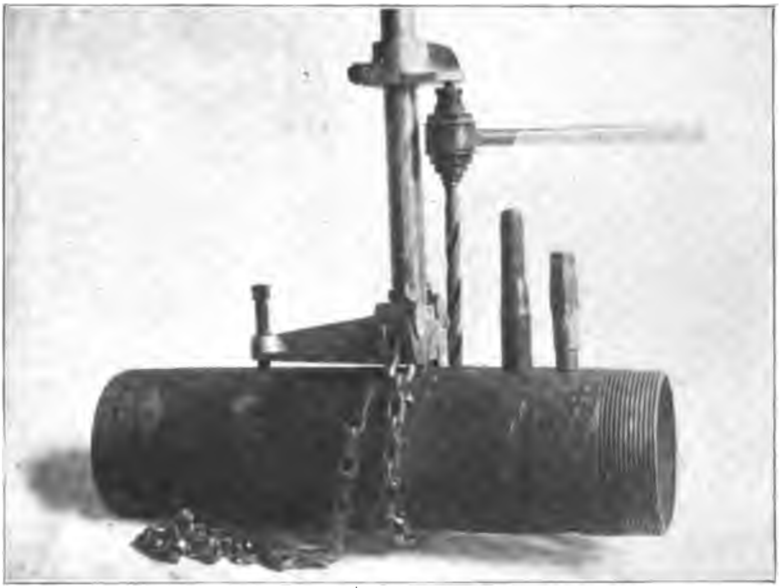
a tubular leg eight inches long, provided with a celluloid scale graduated on one side to read from 0 to 100" of water pressure and using mercury in the bulb and on the other side reading from 0 to 7" of water pressure, water being used in the bulb. The entire outfit is mounted in a maple case 1⅞" x 3" x 10" and when provided with sufficient mercury to fill the bulb weighs one and three-quarters pounds. It serves with equal accuracy the same purpose for which a 100" water column was previously used.

WRINKLE NO. 112.

"YOUNG MAN" FROM "OLD MAN," AND THERMOMETER WELL.

T. H. KERR, ENGINEER, THE OHIO FUEL SUPPLY COMPANY, COLUMBUS, OHIO.

The cut herewith shows an adaptation of the commonly called "Old Man" for the purpose of drilling and tapping half inch or smaller pipe taps in gas lines up to and including ten inches in diameter for the purpose of installing thermometer wells. The thermometer well shown is of our own construction, being fabricated from ½″ and ⅜″ pipe oxwelded together. These thermometer wells are very cheaply made though substantial and are installed in connection with each orifice or proportional gas measuring apparatus.



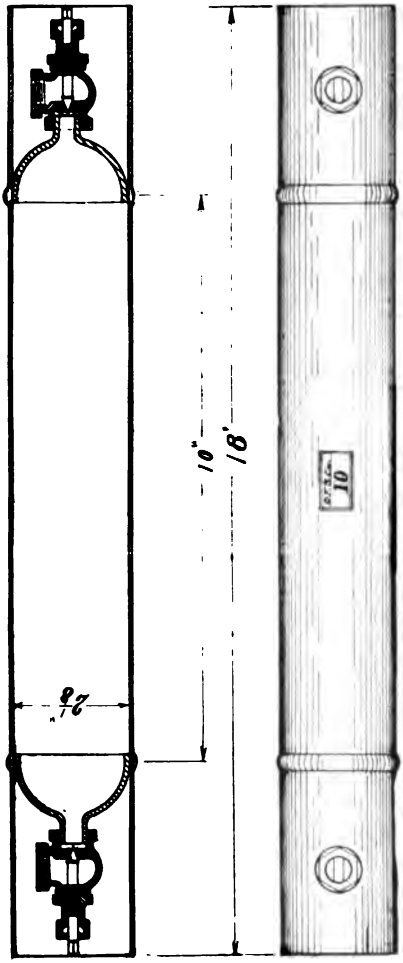
Wrinkle No. 112.

WRINKLE NO. 113.

FOR GETTING SAMPLES OF GAS UNDER PRESSURE.

T. H. KERR, ENGINEER, THE OHIO FUEL SUPPLY COMPANY, COLUMBUS, OHIO.

The accompanying illustration shows gas sampling tank which has proven very convenient for collecting samples of gas in its natural state at any pressure up to five hundred pounds per square inch. It is entirely made of Shelby seamless tubing and provided with ¼ inch angle needle valves, the entire outfit weighing but four and one-quarter pounds. They are provided with brass number plates soldered securely to the center of the drum as a means of identification. They have proven themselves very superior to the old method of collecting gas samples by water displacement.



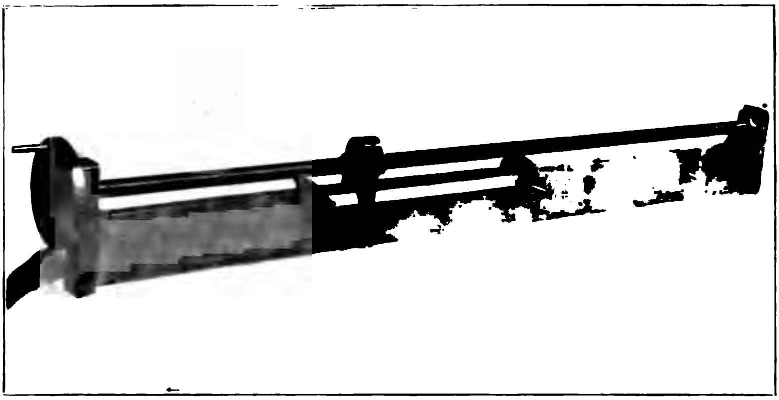
Wrinkle No. 113.

WRINKLE NO. 114.

APPARATUS FOR MAKING POSITIVE GRADUATIONS.

T. H. KERR, ENGINEER, THE OHIO FUEL SUPPLY COMPANY,
COLUMBUS, OHIO.

The apparatus shown in the accompanying illustration was designed primarily for the accurate dividing of the scales for use in the mercury test gauges as shown above but it was equally applicable to the dividing of special slide rules and other similar purposes. The feed screw was provided with twenty threads per inch and the graduated hand wheel with fifty equal graduations thus making it possible to obtain positive graduations to 1/1000 of an inch while by estimating graduations of 1/10000 of an inch may be quite readily obtained.



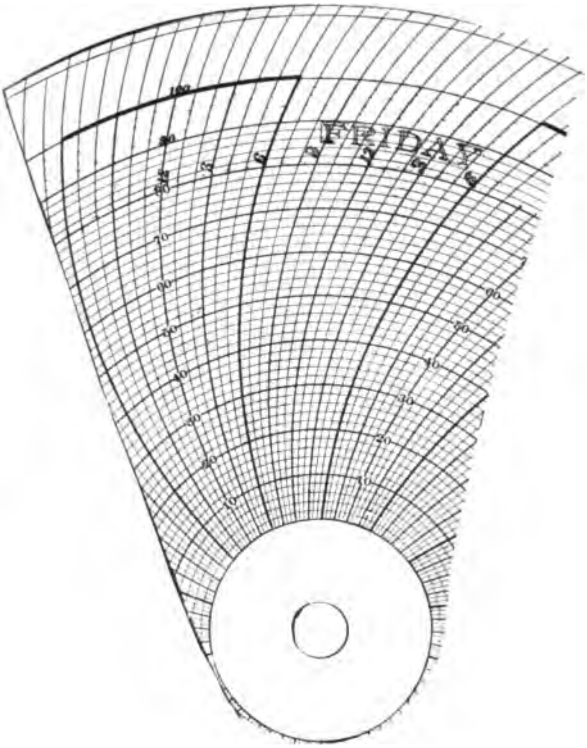
Wrinkle No. 114.

WRINKLE NO. 115.

CHANGE IN RECORDING GAUGE CHARTS.

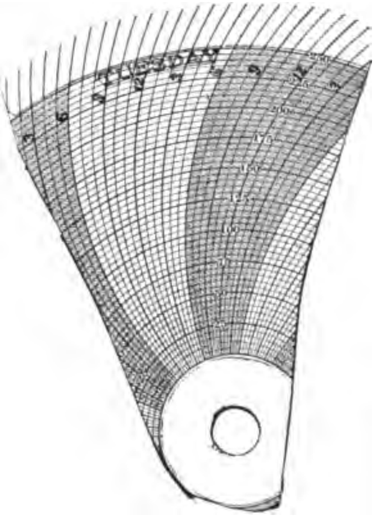
T. H. KERR, ENGINEER, THE OHIO FUEL SUPPLY COMPANY,
COLUMBUS, OHIO.

The accompanying illustrations show a rearrangement of the printed matter on recording gauge charts for use in connection



Wrinkle No. 115.

with orifice meters, providing for a blank ruled margin on the static pressure charts for the insertion of the average pressures and a similar blank space on the 100″ differential charts between 90 and 100 for the insertion of the average differential pressures. This space between 90 and 100 carries the usual graduations except that they are indicated by a short dotted line showing the intersection with the radial hour lines. By this arrangement computation of the charts is very much easier because when the charts have been placed together, that is, the static pressure chart has been placed on top of the larger differential chart with the corresponding times adjoining the average static pressures and the average differential pressures are readily readable, not being written over printed matter as in the old style charts. The outer margin on the differential chart is ruled radially and affords ample space for the insertion of the values representing $\sqrt{HxP}$ or commonly called extensions. Inasmuch as these charts are handled at least four times in process of computation the labor saved by the new arrangement is very considerable.



Wrinkle No. 115.

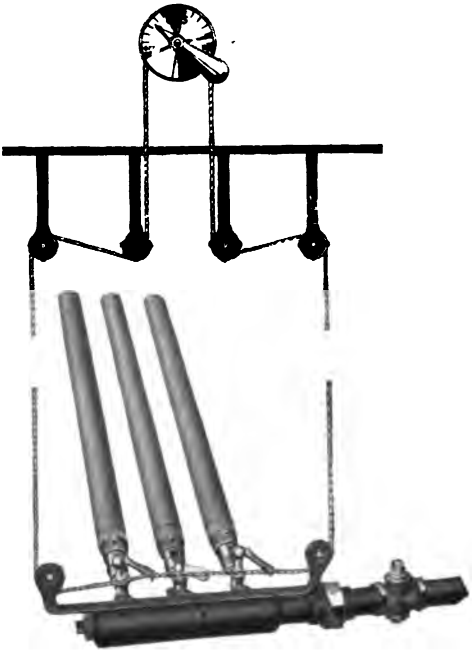
WRINKLE NO. 116.

REGULATING GAS FROM UPSTAIRS.

L. L. Weisenberger, Industrial Engineer, The New Business Department, The Ohio Fuel Supply Company,
Columbus, Ohio.

Use a combination of burners with manifold connected with a gas valve and air mixer, that works automatically, adjusting the percentage of air to the amount of gas used. The cut shows the combination in addition to a suggestion of operating one burner by hand as a pilot light that will not blow out and at the same time, generate a moderate amount of heat, while if more heat is desired, the valves and mixers can be operated from the room above. Back fire, blowing out pilot light and the trips to the basement are avoided.

Another method which gives about the same results is to connect a chain to a quick opening lever valve, run this chain to first floor room above the furnace. This can be operated off or on by lowering or lifting the chain. Of course, the pilot light is bypassed.



Wrinkle No. 116.

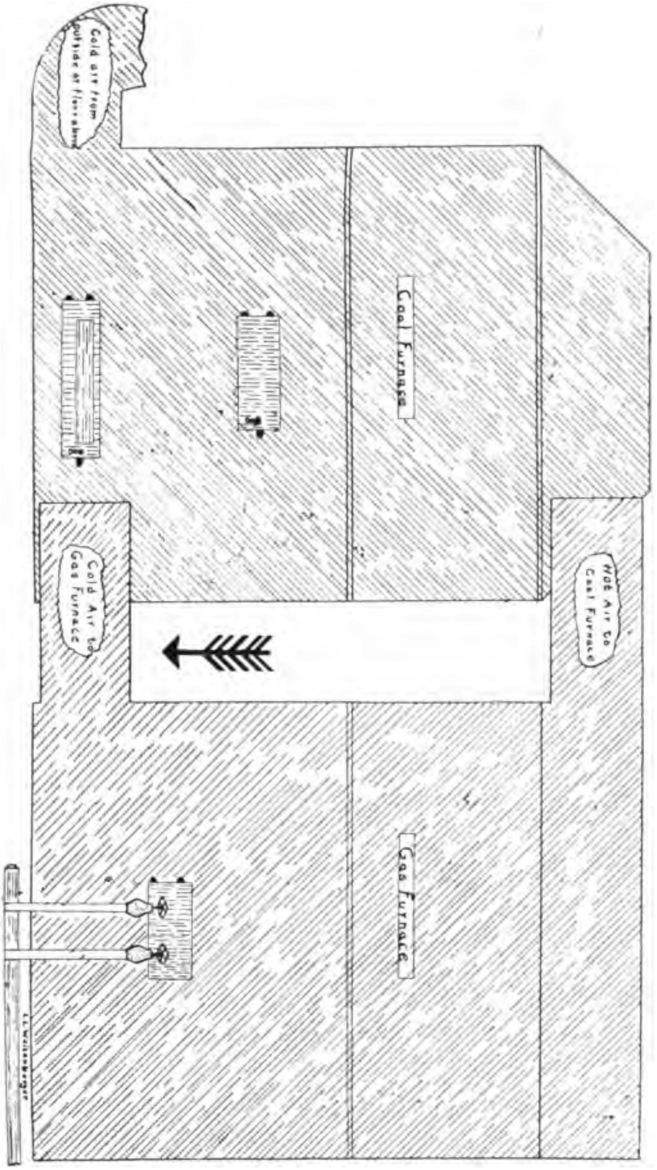
WRINKLE NO. 117.

SHOWING METHOD OF ATTACHING AUXILIARY GAS FURNACE TO COAL FURNACE.

L. L. Weisenberger, Industrial Engineer, The New Business
Department, The Ohio Fuel Supply Company,
Columbus, Ohio.

Cold air is taken from bottom of coal furnace regardless of where the coal furnace takes its air. All runs on coal furnace interfering with warm air tie-in are disconnected and either tied into gas furnace or the tie-in boot.

Showing Method of Installing Auxillary Gas Furnace



Wrinkle No. 117.

WRINKLE NO. 118.

SHOWING METHOD OF GETTING GOOD COMBUSTION ON A BURNER FROM THREE FEET TO FORTY FEET IN LENGTH.

L. L. WEISENBERGER, INDUSTRIAL ENGINEER, NEW BUSINESS DEPARTMENT, THE OHIO FUEL SUPPLY COMPANY, COLUMBUS, OHIO.

Burner may be constructed with any size pipe. Figures are used here merely to demonstrate.

This burner, as shown by the accompanying drawings, consists of a 3″ pipe of any desired length with a cap on one end and a 3″ x 2″ coupling on the other end. The small end of the coupling is reamed out so as to let a 2″ pipe pass through it.

The 3″ pipe is drilled on top (see sketch) with 5/32″ burner holes, facing up. The 2″ pipe with cap on end is drilled with the same number of 5/32″ holes and placed inside the 3″ pipe with holes facing down. Use valve and mixer to correspond with smaller pipe.

Submitted with apologies to the Natural Gas Engineers and Commercial Managers Club.

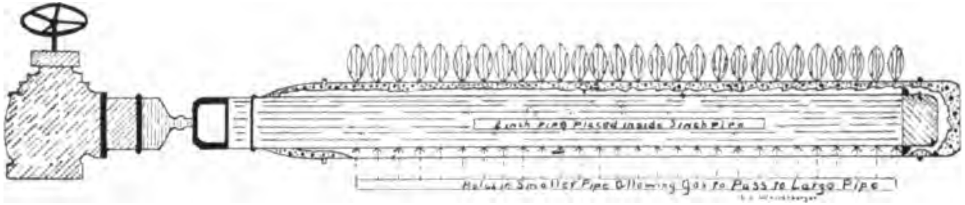
WRINKLE NO. 119.

TABLE TO BE USED WITH PRESSURE BOOKS.

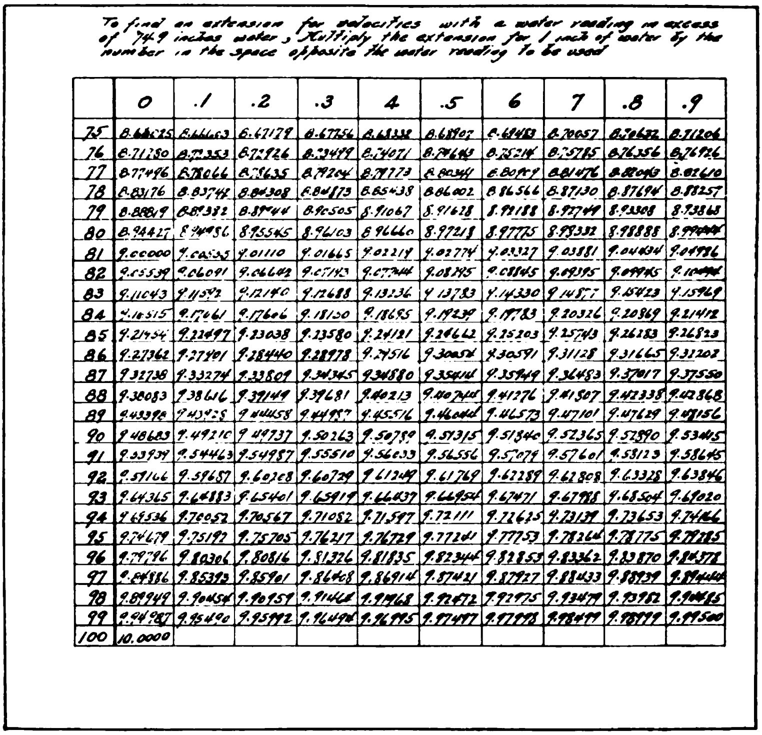
C. L. CUTLER, CHART DEPT., THE OHIO FUEL SUPPLY CO., COLUMBUS, OHIO.

Frequently in computing Orifice Meter Delivery charts it is necessary to calculate extensions ($\sqrt{H \times P}$) for velocities with water readings in excess of 75 inches or beyond the limits of the pressure extension books. This—at best—is a very slow and tedious operation.

Note table which is self-explanatory, to be used in conjunction with pressure books for this work.


2 inch Pipe Placed inside 3 inch Pipe
Holes in Smaller Pipe allowing Gas to Pass to Large Pipe

Wrinkle No. 118.



To find an extension for velocities with a water reading in excess of 74.9 inches water, Multiply the extension for 1 inch of water by the number in the space opposite the water reading to be used

	0	.1	.2	.3	4	.5	6	7	.8	.9
75	8.66025	8.66603	8.67179	8.67756	8.68332	8.68907	8.69483	8.70057	8.70632	8.71206
76	8.71780	8.72353	8.72926	8.73499	8.74071	8.74643	8.75214	8.75785	8.76356	8.76926
77	8.77496	8.78066	8.78635	8.79204	8.79773	8.80341	8.80909	8.81476	8.82043	8.82610
78	8.83176	8.83744	8.84308	8.84873	8.85438	8.86002	8.86566	8.87130	8.87694	8.88257
79	8.88819	8.89382	8.89944	8.90505	8.91067	8.91628	8.92188	8.92749	8.93308	8.93868
80	8.94427	8.94956	8.95545	8.96103	8.96660	8.97218	8.97775	8.98332	8.98888	8.99444
81	9.00000	9.00555	9.01110	9.01665	9.02219	9.02774	9.03327	9.03881	9.04434	9.04986
82	9.05539	9.06091	9.06642	9.07193	9.07744	9.08295	9.08845	9.09395	9.09945	9.10494
83	9.11043	9.11592	9.12140	9.12688	9.13236	9.13783	9.14330	9.14877	9.15423	9.15969
84	9.16515	9.17061	9.17606	9.18150	9.18695	9.19239	9.19783	9.20326	9.20869	9.21412
85	9.21954	9.22497	9.23038	9.23580	9.24121	9.24662	9.25203	9.25743	9.26283	9.26823
86	9.27362	9.27901	9.28440	9.28978	9.29516	9.30054	9.30591	9.31128	9.31665	9.32202
87	9.32738	9.33274	9.33809	9.34345	9.34880	9.35414	9.35949	9.36483	9.37017	9.37550
88	9.38083	9.38616	9.39149	9.39681	9.40213	9.40744	9.41276	9.41807	9.42338	9.42868
89	9.43398	9.43928	9.44458	9.44987	9.45516	9.46044	9.46573	9.47101	9.47629	9.48156
90	9.48683	9.49210	9.49737	9.50263	9.50789	9.51315	9.51840	9.52365	9.52890	9.53445
91	9.53939	9.54463	9.54987	9.55510	9.56033	9.56556	9.57079	9.57601	9.58123	9.58645
92	9.59166	9.59657	9.60208	9.60729	9.61249	9.61769	9.62289	9.62808	9.63328	9.63846
93	9.64365	9.64883	9.65401	9.65919	9.66437	9.66954	9.67471	9.67988	9.68504	9.69020
94	9.69536	9.70052	9.70567	9.71082	9.71597	9.72111	9.72625	9.73139	9.73653	9.74166
95	9.74679	9.75192	9.75705	9.76217	9.76729	9.77241	9.77753	9.78264	9.78775	9.79285
96	9.79796	9.80306	9.80816	9.81326	9.81835	9.82344	9.82853	9.83362	9.83870	9.84378
97	9.84886	9.85393	9.85901	9.86408	9.86914	9.87421	9.87927	9.88433	9.88939	9.89444
98	9.89949	9.90454	9.90959	9.91464	9.91968	9.92472	9.92975	9.93479	9.93982	9.94485
99	9.94987	9.95490	9.95992	9.96494	9.96995	9.97497	9.97998	9.98499	9.98999	9.99500
100	10.0000									

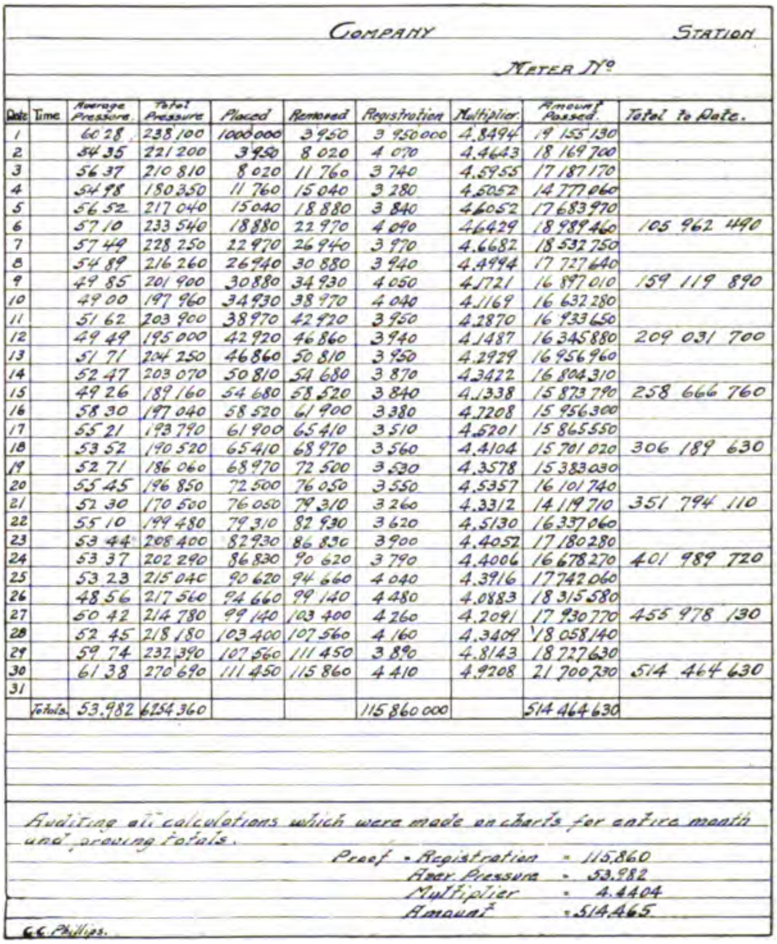
Wrinkle No. 119.

WRINKLE NO. 120.

A METHOD FOR PROVING MONTH'S GAS DELIVERY.

C. C. PHILLIPS, THE OHIO FUEL SUPPLY CO., COLUMBUS, OHIO.

Herewith sample entry record of a month's delivery through Westinghouse Proportional Meter showing a very complete record in itself, and illustrating simple but precise method of proving month's calculations. If the daily delivery is of no interest, entries may be made for the registration and total pressures only, and the entire month's delivery computed as one chart at end of month. Our multipliers are all taken from tables and are not computed by hand. We find this record very proficient.



COMPANY STATION

METER No

Date	Time	Average Pressure.	Total Pressure	Placed	Removed	Registration	Multiplier.	Amount Passed.	Total to Date.
1		60 28	238 100	1000 000	3 950	3 950 000	4.8494	19 155 130	
2		54 35	221 200	3 950	8 020	4 070	4.4643	18 169 700	
3		56 37	210 810	8 020	11 760	3 740	4.5955	17 187 170	
4		54 98	180 350	11 760	15 040	3 280	4.5052	14 777 060	
5		56 52	217 040	15 040	18 880	3 840	4.6052	17 683 970	
6		57 10	233 540	18 880	22 970	4 090	4.6429	18 989 460	105 962 490
7		57 49	228 250	22 970	26 940	3 970	4.6682	18 532 750	
8		54 89	216 260	26 940	30 880	3 940	4.4994	17 727 640	
9		49 85	201 900	30 880	34 930	4 050	4.1721	16 897 010	159 119 890
10		49 00	197 960	34 930	38 970	4 040	4.1169	16 632 280	
11		51 62	203 900	38 970	42 920	3 950	4.2870	16 933 650	
12		49 49	195 000	42 920	46 860	3 940	4.1487	16 345 880	209 031 700
13		51 71	204 250	46 860	50 810	3 950	4.2929	16 956 960	
14		52 47	203 070	50 810	54 680	3 870	4.3422	16 804 310	
15		49 26	189 160	54 680	58 520	3 840	4.1338	15 873 790	258 666 760
16		58 30	197 040	58 520	61 900	3 380	4.7208	15 956 300	
17		55 21	193 790	61 900	65 410	3 510	4.5201	15 865 550	
18		53 52	190 520	65 410	68 970	3 560	4.4104	15 701 020	306 189 630
19		52 71	186 060	68 970	72 500	3 530	4.3578	15 383 030	
20		55 45	196 850	72 500	76 050	3 550	4.5357	16 101 740	
21		52 30	170 500	76 050	79 310	3 260	4.3312	14 119 710	351 794 110
22		55 10	199 480	79 310	82 930	3 620	4.5130	16 337 060	
23		53 44	208 400	82 930	86 830	3 900	4.4052	17 180 280	
24		53 37	202 290	86 830	90 620	3 790	4.4006	16 678 270	401 989 720
25		53 23	215 040	90 620	94 660	4 040	4.3916	17 742 060	
26		48 56	217 560	94 660	99 140	4 480	4.0883	18 315 580	
27		50 42	214 780	99 140	103 400	4 260	4.2091	17 930 770	455 978 130
28		52 45	218 180	103 400	107 560	4 160	4.3409	18 058 140	
29		59 74	232 390	107 560	111 450	3 890	4.8143	18 727 630	
30		61 38	270 690	111 450	115 860	4 410	4.9208	21 700 730	514 464 630
31									
	Totals.	53.982	6254 360			115 860 000		514 464 630	

Auditing all calculations which were made on charts for entire month and proving totals.

Proof - Registration - 115,860
Aver. Pressure - 53.982
Multiplier - 4.4404
Amount - 514,465

C. C. Phillips.

Wrinkle No. 120.

WRINKLE NO. 121.

TABLE GIVING MULTIPLIERS FOR GAUGE PRESSURES.

FRANK PHILLIPS, CHART DEPT., THE OHIO FUEL SUPPLY CO., COLUMBUS, OHIO.

In all our Westinghouse and Wylie Meter chart computations we carry each average pressure to the second place in the decimal. Please note table herewith giving multipliers for gauge pressures from 1 lb. to 100 lbs. and all intermediate decimal equivalents.

Finding multiplier for 94.86.

From table....	94.00	7.03896
	.86	.05584
	94.86 lbs.	7.09480

We are using these tables on all of our work, and find them to be quite advantageous.

WRINKLE NO. 122.

PLUGGING LEAKS ON HIGH PRESSURE LINES.

JOHN D. SYKES, THE OHIO FUEL SUPPLY CO., COLUMBUS, OHIO.

Perhaps this sounds too easy to be true, but I have been able to stop some bad leaks on our high pressure lines, carrying from 200 to 400 pounds pressure, by simply driving in a wooden wedge.

But the fact that I use black walnut, shaped like shown in the cut, is the secret of the success. I make these plugs with a smooth polished, finely-tapered point, with one edge flat and the other edge curved.

When the leak is discovered, I wet the plug and drive it into the hole with a mallet, hammer or large stone, the razor-like point and edge does not catch the full force of the pressure, but once the plug is in place, the pressure is great enough to mash up the fibre of the walnut, effectively stopping the leak.

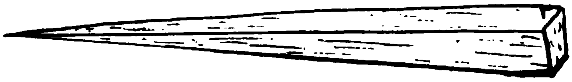
Multipliers at Base 1 lb. Atmosphere 14.4

Pound Multipliers — Decimal Additions.

1	1.00000	21	2.29870	41	3.59740	61	4.89610	81	6.19481	.01	.00065	.21	.01364	.41	.02662	.61	.03961	.81	.05260
2	1.06494	22	2.36364	42	3.66234	62	4.96104	82	6.25974	.02	.00130	.22	.01429	.42	.02727	.62	.04026	.82	.05325
3	1.12987	23	2.42857	43	3.72727	63	5.02597	83	6.32468	.03	.00195	.23	.01494	.43	.02792	.63	.04091	.83	.05390
4	1.19481	24	2.49351	44	3.79221	64	5.09091	84	6.38961	.04	.00260	.24	.01558	.44	.02857	.64	.04156	.84	.05455
5	1.25974	25	2.55844	45	3.85714	65	5.15584	85	6.45455	.05	.00325	.25	.01623	.45	.02922	.65	.04221	.85	.05519
6	1.32468	26	2.62338	46	3.92208	66	5.22078	86	6.51948	.06	.00390	.26	.01688	.46	.02987	.66	.04286	.86	.05584
7	1.38961	27	2.68831	47	3.98701	67	5.28571	87	6.58442	.07	.00455	.27	.01753	.47	.03052	.67	.04351	.87	.05649
8	1.45455	28	2.75325	48	4.05195	68	5.35065	88	6.64935	.08	.00519	.28	.01818	.48	.03117	.68	.04416	.88	.05714
9	1.51948	29	2.81818	49	4.11688	69	5.41559	89	6.71429	.09	.00584	.29	.01883	.49	.03182	.69	.04481	.89	.05779
10	1.58442	30	2.88312	50	4.18182	70	5.48052	90	6.77922	.10	.00649	.30	.01948	.50	.03247	.70	.04545	.90	.05844
11	1.64935	31	2.94805	51	4.24675	71	5.54546	91	6.84416	.11	.00714	.31	.02013	.51	.03312	.71	.04610	.91	.05909
12	1.71429	32	3.01299	52	4.31169	72	5.61039	92	6.90909	.12	.00779	.32	.02078	.52	.03377	.72	.04675	.92	.05974
13	1.77922	33	3.07792	53	4.37662	73	5.67533	93	6.97403	.13	.00844	.33	.02143	.53	.03442	.73	.04740	.93	.06039
14	1.84416	34	3.14286	54	4.44156	74	5.74026	94	7.03896	.14	.00909	.34	.02208	.54	.03506	.74	.04805	.94	.06104
15	1.90909	35	3.20779	55	4.50649	75	5.80519	95	7.10390	.15	.00974	.35	.02273	.55	.03571	.75	.04870	.95	.06169
16	1.97403	36	3.27273	56	4.57143	76	5.87013	96	7.16883	.16	.01039	.36	.02338	.56	.03636	.76	.04935	.96	.06234
17	2.03896	37	3.33766	57	4.63636	77	5.93507	97	7.23377	.17	.01104	.37	.02403	.57	.03701	.77	.05000	.97	.06299
18	2.10390	38	3.40260	58	4.70130	78	6.00000	98	7.29870	.18	.01169	.38	.02468	.58	.03766	.78	.05065	.98	.06364
19	2.16883	39	3.46753	59	4.76623	79	6.06494	99	7.36364	.19	.01234	.39	.02532	.59	.03831	.79	.05130	.99	.06429
20	2.23377	40	3.53247	60	4.83117	80	6.12987	100	7.42857	.20	.01299	.40	.02597	.60	.03896	.80	.05195	100	.06494

Wrinkle No. 121.

Many of these plugs have been used to stop leaks in our high pressure line in the pipe, and at the couplings, and many of them have been in use for many months, so my theory is proven by actual practice.



Wrinkle No. 122.

Every one knows that a large volume of gas may be lost every hour when a leak starts in the high pressure line and even a greater loss is often caused by the shutting off of the supply, so that these black walnut plugs have saved many thousands of dollars.

These plugs can be carried in the pocket or whittled in a few minutes, while many times a leak starts miles away from the nearest shop, where clamps or saddles can be secured.

WRINKLE NO. 123.

USE HEAVY RIVER HOOKS ON SIDE OF HILL.

OSCAR KREBS, THE OHIO FUEL SUPPLY CO., COLUMBUS, O.

When pipe lines run along the side of a hill, where washouts are liable to occur, we find it advisable to use river hooks imbedded in the bank.

This is simply a safety first device and has been used with success where the bank has started to slide. These hill side hooks are heavier then the regular river hooks, generally about 2½" iron and about seven feet long. We set these in concrete bases and they have proven to be very successful.

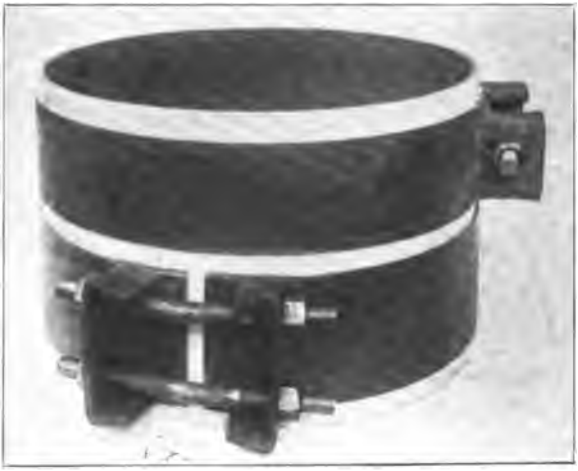
WRINKLE NO. 124.

MODERN DRAW BAND USED BY THE OHIO FUEL SUPPLY CO.

OSCAR KREBS, THE OHIO FUEL SUPPLY CO., COLUMBUS, OHIO.

The draw bands shown in the photograph are used in place of using expensive saddles to repair holes in high pressure lines caused by electrolysis, minerals in the ground or even a split pipe, when it is not advisable, or very difficult, to shut off the gas. In such cases, these bands can be quickly placed in order to stop the leak.

We use a quarter inch thick soft rubber, cut just large enough to cover the hole and then slip the band over the pipe. These bands are made of 1/8" x 3" iron for the single bolt band and 1/8" x 5" for the double bolt. The lugs for holding bolts are made of 5/16" angle iron and are oxwelded to the band at such an angle (see photograph) that the tightening of the bolts does not strain the lugs, but tightens the band. The bolt holes on the lug are 7/8" which allows a little play for the 3/4" bolt. These bolts are bent to the curve of the pipe and are threaded on each end about three inches so that they can be tightened from both ends.



Wrinkle No. 124.

We use a ratchet wrench for tightening these bands as a monkey wrench will jump off too easily.

Another advantage of this style draw band over the saddles is that the bolts can be placed on top of the pipe or in any handy position for tightening, doing away with the necessity of digging out under pipe and the usual trouble of tightening saddles. With the old style band, we often had trouble with the rivets cutting off, but this new band overcomes most of the difficulties formerly experienced.

WRINKLE NO. 125.

METHOD OF EMPTYING LARGE PIPE LINES BETWEEN GATES.

OSCAR KREBS, THE OHIO FUEL SUPPLY CO., COLUMBUS, OHIO.

When it is necessary to place a 16" or 18" welded tee in a Dresser line where we wish to empty the gas from the line quickly, we have used the following method with success.

Wrinkle No. 125.

We take two large saddles and place them close together on the pipe close to the coupling joint and then we cut this small section of pipe off. This leaves sufficient pipe to connect the pipe ends again and very little pipe is wasted.

WRINKLE NO. 126.

CAULKING LEAKS WITH RUBBER AND LEAD.

A. C. SARCHET, AGENT, THE OHIO FUEL SUPPLY CO., CAMBRIDGE, OHIO.

I use this plan for caulking leaks in either high or low pressure lines.

Take a Dresser collar leak clamp rubber larger than the fitting you wish to lead, clean off the pipe well and also the face of the fitting you wish to caulk, stretch the rubber around the pipe as tight as you can, with the grooved side toward the fitting. Then tack with two tacks and cut a small hole at the top to pour in the lead. Have the joint in the rubber a little to one side of the top so that you can have a hole at the top to put in the lead. The groove in the rubber will let plenty of lead come out, so you can drive it in and stop the leak.

This will save many a cold finger mixing mud on a cold day and will do a much better job.

If you wish to caulk a leak in a two-inch fitting use a three or four-inch rubber. If for three or four-inch, use a six-inch rubber. Cut the rubber down so it will fit tight around the pipe, and be sure to have it tight against the fitting. For six-inch or larger the same size rubber as the fitting will work all right.

WRINKLE NO. 127.

FORM USED IN TESTING SERVICE AND HOUSE LINES.

A. C. SARCHET, AGENT, THE OHIO FUEL SUPPLY CO., CAMBRIDGE, OHIO.

WRINKLE NO. 128.

INDEXED COST AND MATERIAL ACCOUNTING SYSTEM.

L. H. RECOB, NEW BUSINESS DEPARTMENT, THE OHIO FUEL SUPPLY COMPANY, COLUMBUS, OHIO.

We have devised a system of cards by which we can tell at a glance what our stock on hand is at the close of each day.

Our cards are ruled and posted as shown by the accompanying drawing. We make cards for each article carried in stock and debit all material coming into stock and credit all disbursements. We post the cards daily.

The advantage of these cards over the stock book or stock sheets, is that we carry only one item on each card and can replace each card with a new one when it becomes filled on both sides and is much easier to handle when posting. With this

Test Order ○ **No. 1000**

THE OHIO FUEL SUPPLY CO.

House lines tested found..

Service lines tested found..

....

Inspector

☛To be tied to line that has been tested.

- -

Test Order No. 1000

I have tested { **House lines** ( ) / **Service line** ( ) }

Found them ....

....

Inspector

(return this to office)

☛To be returned to office.

- -

Test Order No. 1000

Please inspect { **House line** ( ) / **Service line** ( ) }

For ....

At ....

☛Shop Record.

- -

Test Order No. 1000

Office Record

Test { **House line** ( ) / **Service line** ( ) }

For ....

....**St.**

Date ....

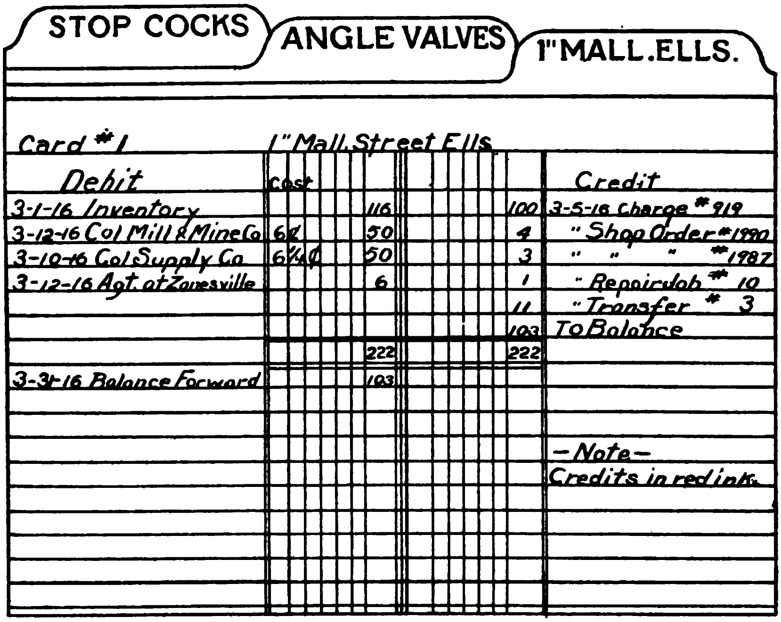
☛Office Record.

(Size: 3½ x 6¼ in.)

Wrinkle No. 127.

system, we carry all sizes of material in rotation, making it more accessible.

Our method of securing data for these cards is to post all material received from the invoices checked as correct by our receiving clerk. This posting includes the number of items and the cost of each item. To this we add our overhead charge for handling, giving us our total cost price.



STOP COCKS ANGLE VALVES 1"MALL.ELLS.

Card #1 1" Mall. Street Ells.

Debit	Cost			Credit
3-1-16 Inventory		116	100	3-5-16 Charge #919
3-12-16 Col Mill & Mine Co	6¢	50	4	" Shop Order #1990
3-10-16 Col Supply Co	6¼¢	50	3	" " " #1987
3-12-16 Agt. at Zanesville		6	1	" Repair Job # 10
			11	" Transfer # 3
			103	To Balance
		222	222	
3-31-16 Balance Forward		103		
				—Note—
				Credits in red ink.

Wrinkle No. 128.

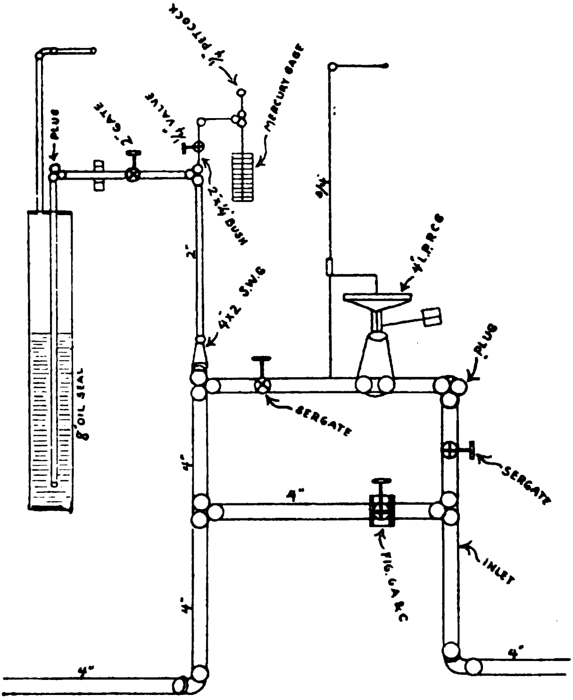
The disbursements of material is secured accurately, because of the fact that no material is disbursed without a written order. These orders are then checked with Shop Orders after fitters return them to office when the work is completed and if material on Shop Order agrees with the written order to the stock man, we post same to our stock cards.

WRINKLE NO. 129.

ONE METHOD OF INSTALLING L. P. REGULATOR.

J. W. Hardwick, The Ohio Fuel Supply Co., Cambridge, Ohio.

I here show a sketch of L. P. Regulator installation. I do not know that there is any new wrinkles to this or not unless it should be the ¼" pet cock which serves as a relief valve to the mercury gauge. You will note, in the sketch, that by closing the ¼" valve on the line leading to gauge and opening the ¼" pet cock that it will relieve the pressure on the gauge and thereby allow the mercury to drop to the bottom of the scale. The man operating the gauge can see at a glance whether or not the mercury stands at the proper place before taking the pressure.



Wrinkle No. 129.

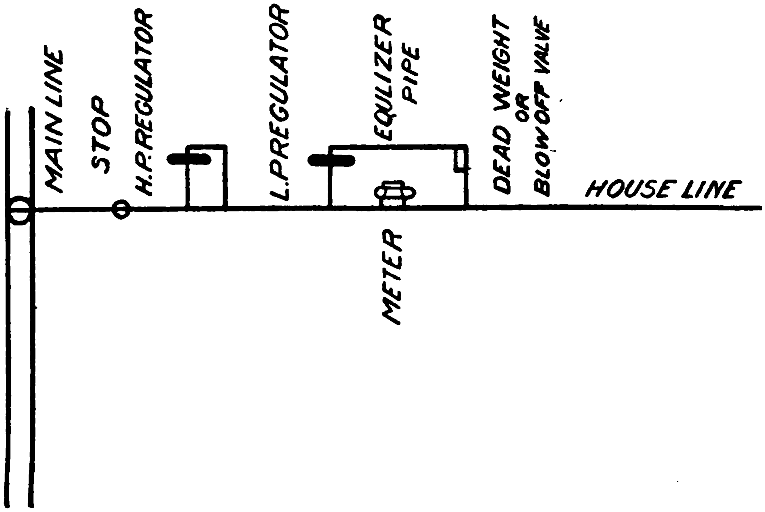
By closing the pet cock again and opening the ¼" valve the mercury will bob up and record the correct pressure. Otherwise, by having no place between the ¼" valve and the gauge to relieve the pressure (and the gauge connections, do not leak). When you close the ¼" valve the mercury does not change its position, consequently you can not tell whether the mercury is working right or not. By this installation you are certain just what your pressure is.

WRINKLE NO. 130.

METHOD OF SETTING METER AND REGULATORS ON HIGH PRESSURE LINES.

John W. Hardwick, Foreman, The Ohio Fuel Supply Company, Cambridge, Ohio.

We have found that rural consumers will allow the regulators to "blow off" and the company loses the gas, with the new method of setting meter the gas is registered by meter and is paid for by consumer.



Wrinkle No. 130.

WRINKLE NO. 131.

A SUGGESTION BOX SUGGESTED.

H. P. ZIESCHANG, CHART DEPT., THE OHIO FUEL SUPPLY CO., COLUMBUS, OHIO.

Employes should cooperate with their employers in every way possible—working for the company they are more or less interested.

On account of the inconvenience, also the amount of time taken up, in the discussion of any ideas singly that might arise, a suggestion box would be a good thing to secure this cooperation, that is, the employes write their ideas on a piece of paper and a place be provided for their reception.

Many thoughts may come to the employe in his work which would never occur to the employer. He is not engaged in the work and naturally would not be able to see the new needs.

The suggestions and ideas should be dropped in a box and collected at certain periods. A meeting of the men in charge of the different departments with the managers should be held in order that the suggestions be read and considered. If it is decided that the suggestions deserve consideration they should be numbered from 1 up and blueprints made, with the answer of the company attached. These should be placed in a glass covered receptacle near all boxes so that employes can see what has been done.

Cooperation of this kind should promote a greater interest and facilitate the solution of any difficulties that might be experienced in some of the work.

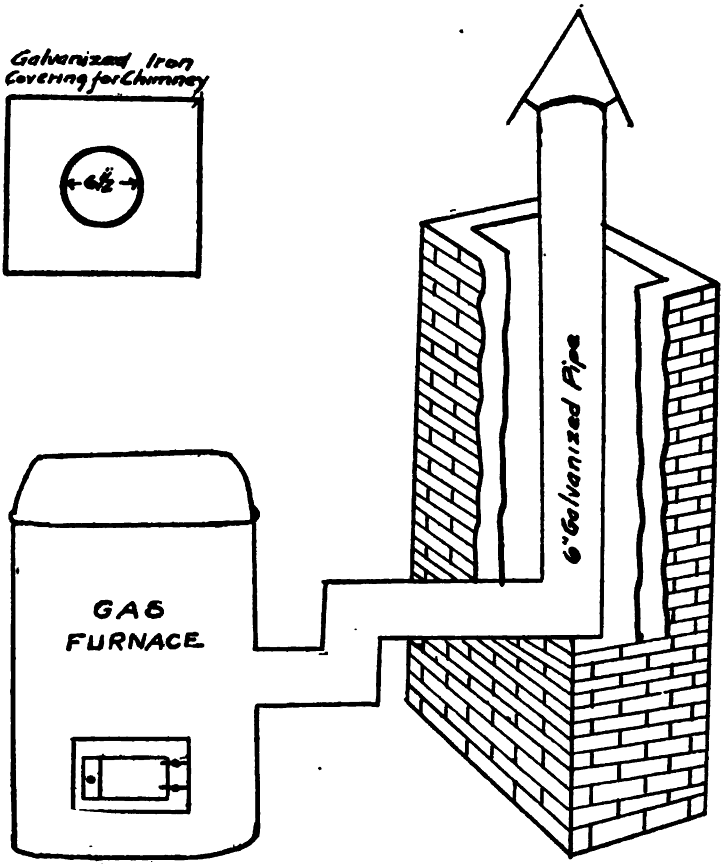
The above has worked successfully with certain large companies and all parties have been benefited.

WRINKLE NO. 132.

STOPPING CHIMNEY "SWEATING" IN OLD HOUSES.

C. E. CARTER, NEW BUSINESS DEPARTMENT, THE OHIO FUEL SUPPLY COMPANY, COLUMBUS, OHIO.

When installing a gas furnace in an old house, where there is no modern flue linings and where the parties have previously used a coal furnace, it very often happens that the chimney is in such a condition that when the moisture in the gas fumes is condensed, by coming in contact with the cold outdoor air or a cold outside wall, the moisture runs down the chimney or seeps through the mortar. This often causes the wall paper in the upstairs rooms to come off.



Wrinkle No. 132.

We have found a very effective way to overcome this difficulty is to run a galvanized pipe, the same size as the flue pipe on the furnace, the length of the chimney and extending it about

18″ above the top of the chimney. A galvanized iron covering is then placed over the top of chimney and a "rain cap" on the pipe as shown in attached drawings.

WRINKLE NO. 133.

USE RUBBER DATE STAMP ON DIAL FACE.

Clyde Vance, The Ohio Fuel Supply Co., New Lexington, Ohio.

A new wrinkle by which a meter reader or inspector is enabled to see the date meter was last tested and repaired on meters that are covered by galvanized covers. As these meters are now stamped, it is difficult to see the date of repairs unless the galvanized cover is removed.

By making use of a small commercial date stamp, the date of repairs and test can be stamped across the face of dial—in center of dial—thus making it plain to be seen at all times and in all places. When meter is returned to shop for a second test, the date of former test can be removed by the use of alcohol or damp rag.

WRINKLE NO. 134.

INSERTING SEVERAL SHEETS IN TYPEWRITER.

Geo. M. Pemberton, Chart Dept., The Ohio Fuel Supply Co., Columbus, Ohio.

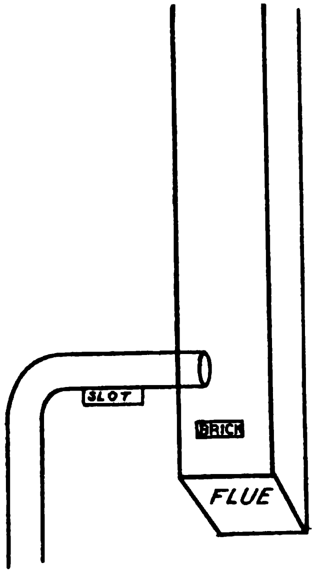
To insert a number of sheets evenly in a typewriter. Fold a piece of paper about four inches wide and the same length as the width of the sheets, slip the folded paper over the ends of sheets and insert in the typewriter. After the paper has passed between the platen and feed rolls, remove folded paper and turn roll back until sheets are in proper position. This will leave the edges even.

WRINKLE NO. 135.

HOW TO STOP DOWN DRAUGHTS.

R. W. Irwin, Agent, The Ohio Fuel Supply Co., Xenia, Ohio.

This rough sketch will give you an idea of what I mean, when I say we have had considerable success in stopping down draughts and chimney sweats by cutting a slot one inch wide by five inches long in the lower side of the flue pipe, about six inches from chimney. Also by taking out a brick in the chimney eight or ten inches below the flue pipe.



Wrinkle No. 135.

WRINKLE NO. 136.

A SUGGESTION TO METER MAKERS.

E. C. Mulock, Agent, The Ohio Fuel Supply Co., Mt. Vernon, Ohio.

There recently was brought to my notice, two meter parts both of brass, and both so badly worn that the meter was dead.

One was the spiral on the crank shaft, and the other, the pinion in the cogs of which the spiral worked.

It strikes me that if the spiral were made of steel, and the pinion of brass, that the wear would not be so rapid as when brass works upon brass, or when iron works on iron or steel. This is worthy of a trial by makers of meters.

WRINKLE NO. 137.

MADE A TESTING GAUGE TO SAVE USE OF MERCURY.

John W. Lehew, The Ohio Fuel Supply Co., Mt. Vernon, Ohio.

I here show a drawing and give a description of a syphon mercury gauge that can be used for pressure and fitters' testing gauge. I gave this a test of 50 lbs. air pressure (which was all the air I could get in our local shop) and much higher than the average medium pressure any place. I believe it would hold its mercury at a much higher pressure.

The high price of mercury gave me this idea. I believe it a good safe gauge and they are necessary in testing recording and other spring gauges.

DESCRIPTION.

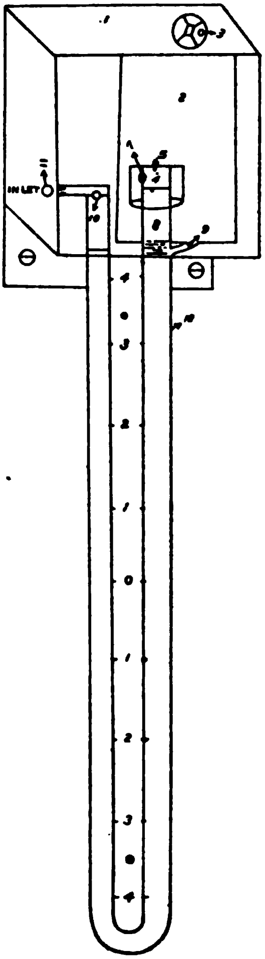
Made of cast iron pipe fittings and U. glass tube.

No. of parts.	Name of parts.
(1)	Case. Solid iron body.
(2)	Mercury chamber.
(3)	Filling port, and relief opening, 1" plug drilled to 3/32.
(4)	Breaker 1/8 cap.
(5)	Connecting bolt.
(6)	Baffler, 3/8 cap.
(7)	Overflow, 4/32 opening in No. 4.
(8)	Standpipe, 1/8 pipe nipple.
(9)	Mercury inlet, 3/32 opening.
(10)	Gas inlet to tube, 2/32 opening.
(11)	Main inlet, 1/8 pipe tap.
(12)	U. glass tube.

TEST.

Retained mercury at 50 lbs. air pressure. Refilled at 4 lbs. air pressure.

Wrinkle No. 137.



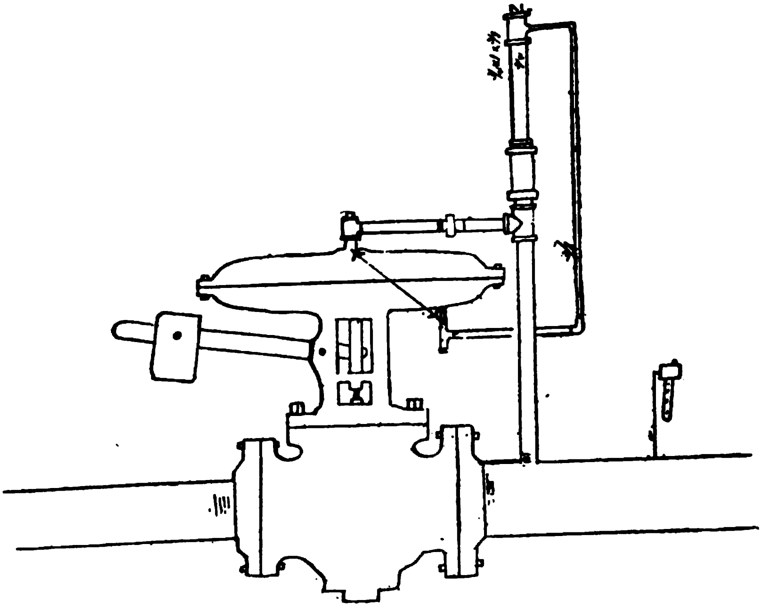
Wrinkle No. 137.

WRINKLE NO. 138.

LOW PRESSURE REGULATOR WORKING UNDER WATER.

JOHN W. LEHEW, THE OHIO FUEL SUPPLY CO., MT. VERNON, OHIO.

Connect ⅜" pipe from relief opening in lower diaphragm cover and extend to high water line. Using the same size orifice in nipple as was originally used in regulator before making tap, or the same size as orifice in inlet nipple in top cover of regulator. Use tee instead of ell for cleaning out and drainage.



Wrinkle No. 138.

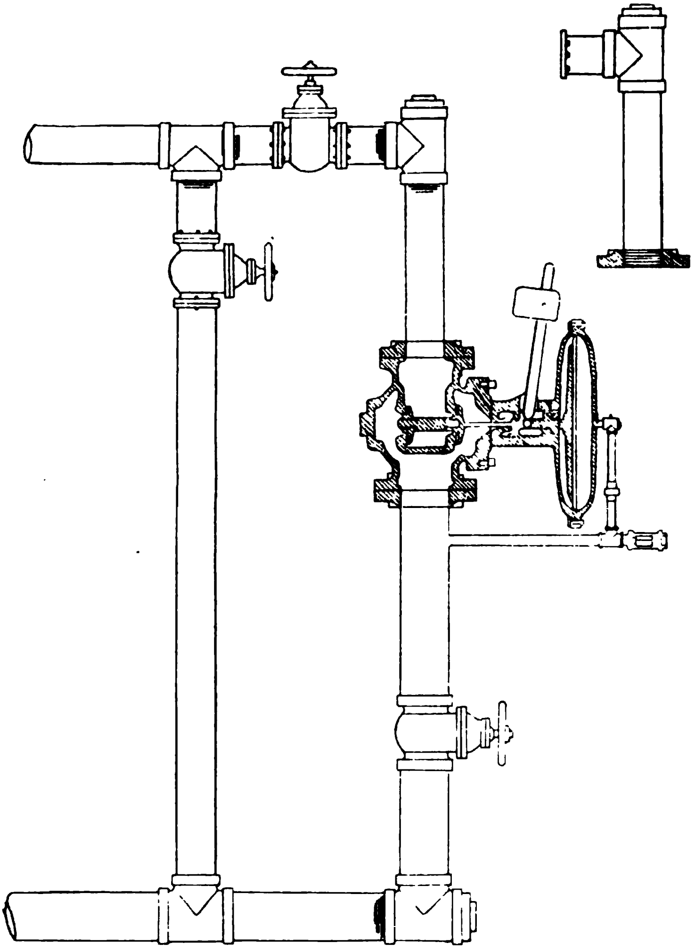
WRINKLE NO. 139.

USING A FLANGE GATE ON THE INLET.

CHARLES SEIBERT, AGENT, THE OHIO FUEL SUPPLY CO., NEW LEXINGTON, OHIO.

This is to call attention to the convenience of using a flange gate on the inlet of a low pressure regulator so that the piece marked "A" (see sketch) can be unbolted and removed for convenience in cleaning, repairing and putting in new rubber valve seats. When a screw gate is used in this place, it is sometimes almost impossible to get the regulator out. This saves time and a lot of trouble as I know by experience.

Perhaps others are setting up their regulators in this manner and there may be some who are not. For those who are not setting them up in this manner, this "Wrinkle" will be helpful



Wrinkle No. 139.

WRINKLE NO. 140.

"A PENNY SAVED IS A PENNY EARNED!"

Charles H. Johnson, The Ohio Fuel Supply Co., Logan, Ohio.

There are two things we are doing in the meter shop here, that I have not found in several places I have been.

As we bring the meters into the shop and put them on the bench to test for stuffing box, we cut the small lead seals off, and put them in a box underneath the bench. We melt these seals and find that the lead is as good for joints, or any other purpose, as if it just come from the store.

We also take the seal wires that comes off the meters and lay them away to be used for sealing Tobey meter covers. I figure that if every shop of The Ohio Fuel Supply Co. was doing this same thing it would mean quite a saving each year.

WRINKLE NO. 141.

NEW FORM OF APPLICATION FOR HIGH PRESSURE GAS.

A. C. Hancock, The Ohio Fuel Supply Co., Mt. Vernon, Ohio.

We need so much information in regard to rural consumers that I think the enclosed form of high pressure applications would be a great help to the bookkeeper.

It would help in making up the reports of the amount of gas consumed from discharge lines and suction lines; also in making up tax reports of the number of meters in each township and county; and the address of the consumer to whom the card is to be mailed each month.

These high pressure applications should be filed each month and kept in alphabetical order so that they can easily be referred to at any time.

APPLICATION FOR NATURAL GAS SERVICE

To The Ohio Fuel Supply Company.

Application is hereby made for Natural gas from your High Pressure line to be used by..
at .... in ....Township
.... County, Ohio, and gas is to be taken from Line .... which is a Suction or Discharge Line.

In consideration whereof, the applicant hereby expressly agrees to the following conditions:

1. The Company is to tap the high pressure carrying line, and install not to exceed ten feet of service line, with a suitable stop-cock.

2. All other necessary pipes, fittings, valves, regulators and appliances, shall be furnished and installed by the applicant at .... costs and expense. The applicant agrees to furnish and install one high pressure and one low pressure regulator not more than seventy-five (75) feet from the high pressure line, and to furnish and install a low pressure dead weight safety valve in the service line leading away from the meter. The applicant is to provide and maintain a suitable space, satisfactory to the company, not less than 10 feet nor more than 15 feet from the low pressure regulator, within which the meter may be set, and to construct and maintain suitable houses over regulators and meters. The applicant agrees to comply with all the conditions of this paragraph before the gas is turned on.

3. As a further consideration for being supplied with natural gas from a high pressure line, the applicant hereby assumes all risk of injury or damage to either person or property caused by variations in the pressure of the gas in said line; defects in pipes, connections or appliances; the escape or leakage of gas; failure of valves or regulators to work properly, and like causes; and the applicant expressly waives any right of recovery against the Company for injury or damage sustained from said causes, or either of them.

4. The applicant hereby agrees to pay for all natural gas furnished, taken or used under the terms of this agreement .... cents per thousand cubic feet, less a discount of .... cents per thousand cubic feet, if payment is made at the office of the Company in ....
.................., Ohio, or to a duly authorized representative of the Company, on or before the 10th of the month for gas furnished the preceding month.

5. The Company shall have the right to shut off the gas at any time for either or any of the following causes: (1) for repairs to its line;

(2) either temporary or permanent failure in the supply of gas; (3) removal of its high pressure lines; (4) failure of applicant to pay on or before the 10th of the month for gas consumed in preceding month; (5) failure or neglect of applicant to use gas economically; (6) for false representations as to the consumption of gas; (7) failure, neglect or refusal of applicant to maintain regulators, lines, fixtures, appliances, etc., in good condition so as to prevent escape, leakage or waste of gas; (8) for violation of any of the provisions of this contract.

6. The Company may remove any property it may have placed upon the premises of the applicant at any time, upon the expiration or cancellation of this contract.

7. This contract may be terminated by either party giving thirty days' notice in writing to the other party.

THE OHIO FUEL SUPPLY COMPANY,
By ....
....
Applicant.
...................., 191.... P. O. Address ....

Wrinkle No. 141.

WRINKLE NO. 142.

RULES FOR METER READERS.

A. C. HANCOCK, THE OHIO FUEL SUPPLY CO., MT. VERNON, OHIO.

Herewith are some rules which I have compiled myself and give to the meter readers of the sub towns, and I find them to be a great help in obtaining information that I desire in using on my ledger.

I send each one a copy of these rules every few months.

RULES FOR METER READERS.

1. If a meter can not be read on your regular trip make a note of the same, and on another day try to read the meter again, then if you are unable to do so write in the reading book the reason you can not read it.
2. If you are unable to obtain the reading of a meter, under no circumstances estimate a reading, but write in the reading book why you are unable to read the meter.

3. If you find a meter that you think is running too slow it should be changed at once, but put down the reading that the meter shows and then write after the reading "Too Slow."
4. If you find a meter that does not register any gas and is dead, it should be changed at once, but put down the reading that the meter shows and after the reading write "DEAD."
5. If a meter reader has a "PASS KEY" he is positively forbidden to use it to enter a house to read a meter even with the consent of the person living in the house.
6. If a meter is over-read one month, then the next time it is read the correct reading should be put down in the reading book, and mark the reading "Over-read."
7. In reading Rural meters the reader should walk over the consumer's service line from the High Pressure line to the meter and notify him to repair any defects in piping or regulators. In case he refuses to do the same notify the office.
8. In reading rural meters you should see that the regulators are all right, and that they are properly housed. In case they are not housed notify the consumer to do so at once.

WRINKLE NO. 143.

LIVE TIPS ON REPAIRING GAS METERS.

J. A. Spear, The Ohio Fuel Supply Company, Cambridge, Ohio.

To change the crank frame on a No. 1 Tobey meter without moving the covers, take off bottom and head and remove the stuffing box. Then use a long shanked screw driver.

In repairing an Ironclad meter when you wish to learn if valve seat is level before bolting, cut a leather gasket the same size as top of meter. Join together with four 3″ clamps, but do not use shellac. Connect to gas meter to learn if seat is level burning one light. If meter moves the seat is level and the diaphragms have no holes in them.

With a Keystone meter, I remove the covers, take out cage without the use of soldering iron. To learn if seat is level, bolt on three covers, but before bolting on the fourth cover, cut leather gasket the size of cover. Then first put on the gasket, second the diaphragm and third the cover, using eight bolts, without shellac. Then connect to gas to learn if level. If not, take off cover and grind again. To learn if valve seat is level, connect meter to gas with one light burning. If meter moves, the seat is level and diaphragms tight.

When seat is not level in an Equitable meter, remove bottom and grind the seat. To learn if seat is level, before bolting together, set on the same place as valve seat, a piece of iron a quarter of an inch larger than the valve seat. Pour melted lead over this surface, under the iron, leaving a hole in each piece of lead the size of a lead pencil, placing the lead under valve seat. Cut leather gaskets the size of bottom, leaving holes as valve seat, then place on the leather gasket and bolt on valve seat. Join the bottom to body with four 3" clamps and tap same. Use no shellac. These lead pieces may be used in any equitable meter, when testing out valve seat to see if level. Connect meter to gas with one light burning as in other tests.

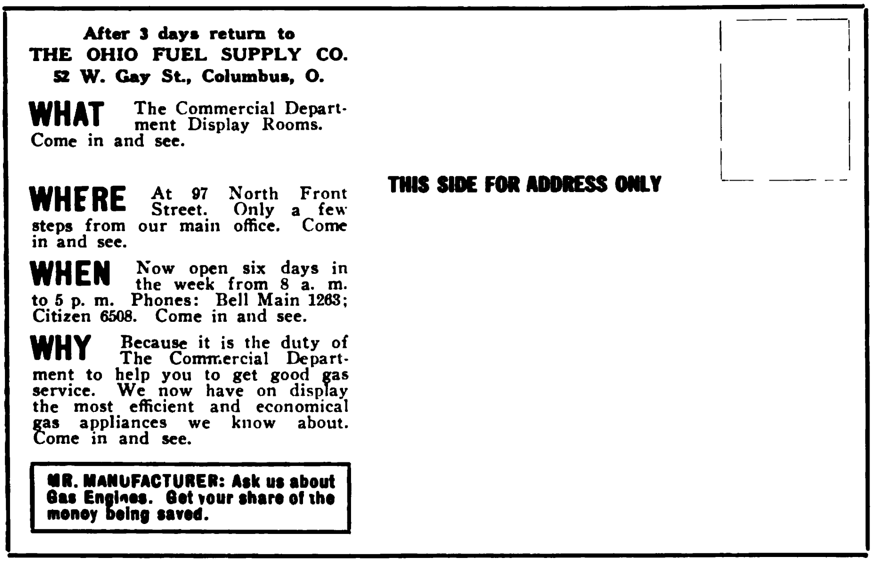
WRINKLE NO. 144.

ADVERTISEMENT OR NOTICE ON POST CARD BILLS.

NEW BUSINESS DEPARTMENT, THE OHIO FUEL SUPPLY COMPANY, COLUMBUS, OHIO.

Uncle Sam will permit you to use one-third of the address side of a post card for any legitimate printed announcement and he will also return any such card to sender if the return address is printed on the address side, as shown in attached drawing. This not only assures you that the consumer will read what you have to tell him, but if party has gone, leaving no address, or the card wrongly addressed, the postmaster returns it to you.

(FRONT)



After 3 days return to
THE OHIO FUEL SUPPLY CO.
52 W. Gay St., Columbus, O.

WHAT The Commercial Department Display Rooms. Come in and see.

WHERE At 97 North Front Street. Only a few steps from our main office. Come in and see.

WHEN Now open six days in the week from 8 a. m. to 5 p. m. Phones: Bell Main 1263; Citizen 6508. Come in and see.

WHY Because it is the duty of The Commercial Department to help you to get good gas service. We now have on display the most efficient and economical gas appliances we know about. Come in and see.

MR. MANUFACTURER: Ask us about Gas Engines. Get your share of the money being saved.

THIS SIDE FOR ADDRESS ONLY

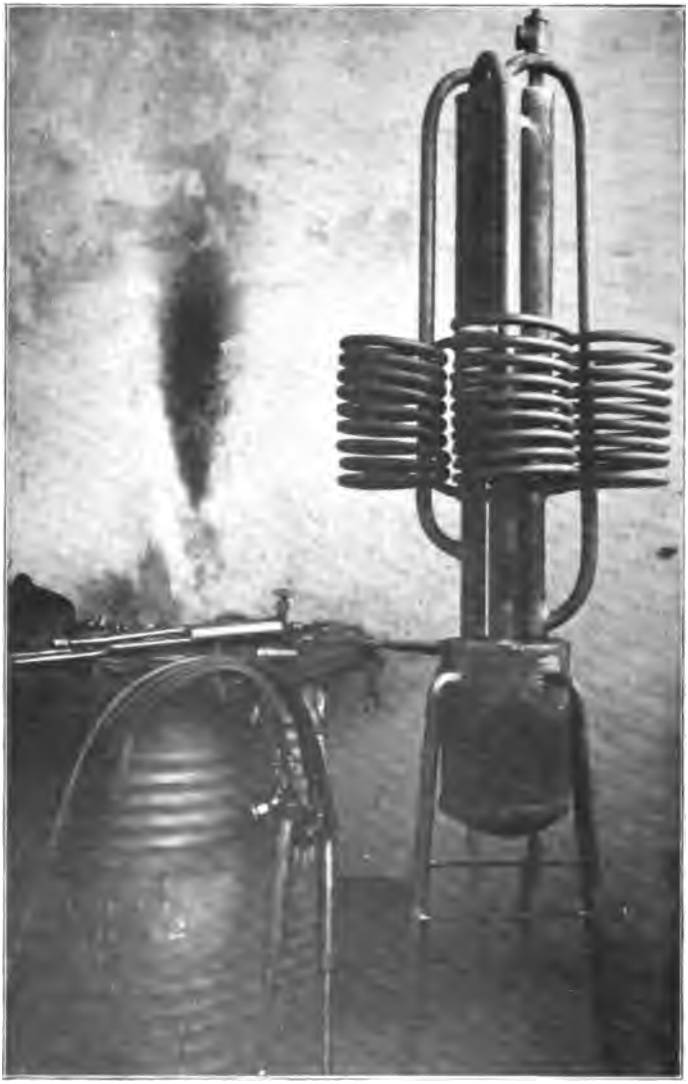
Wrinkle No. 144.

WRINKLE NO. 145.

ABSORBER FOR FINDING GASOLINE IN GAS.

P. McDonald Biddison, Construction Engineer, The Ohio Fuel Supply Co., Columbus, O.

The apparatus shown in photograph herewith is an absorber made from pipe sections for testing gases for their gasoline content. The large reservoir at the bottom is filled with Mineral Seal Oil and the gas to be tested passed through the absorber, passing through each of the coils of pipe in turn and carrying oil from the bottom reservoir into the 2″ chambers above, from which chamber the oil drains back into the bottom reservoir while the gas passes out at the top into the bottom reservoir and out through the next coil. This arrangement gives a good circulation of oil in the absorber and is found to be very efficient.



Wrinkle No. 145.

WRINKLE NO. 146.

SOLDER POT.

H. C. MORRIS, GEN. MGR., THE DALLAS GAS CO., DALLAS TEXAS.

The attached sheet and photograph show an easily constructed solder pot made up from an old oven burner and facilitates the tinning of meter repair parts.

WRINKLE NO. 147.

PRESSURE CHART RACK.

H. C. MORRIS, GEN. MANAGER, THE DALLAS GAS CO., DALLAS, TEXAS.

The sheet and photograph show an easily constructed rack for the filing of pressure charts, which is found to be especially convenient for making quick observations of pressure charts for different districts for the same date or for comparing charts of the same station with any period.

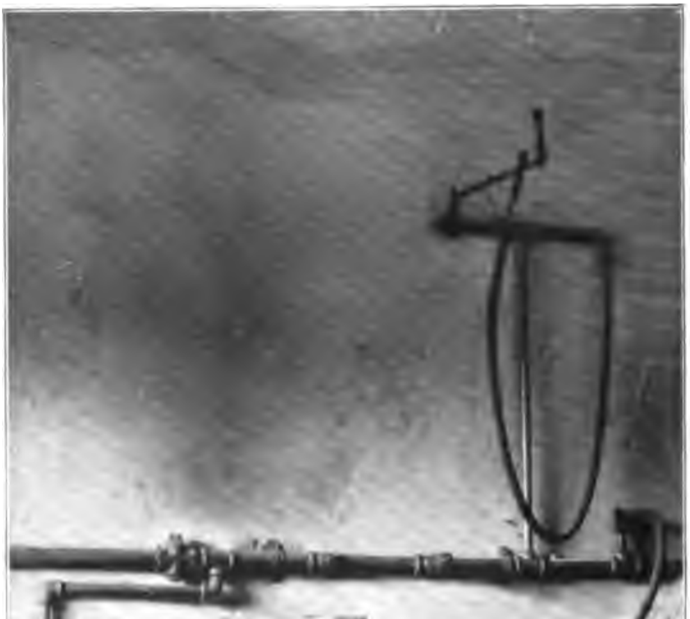
Charts are filed on rack, the last date on top, for a period of 5 weeks, at the end of which time the previous month's charts are removed from rack and permanently filed.

WRINKLE NO. 148.

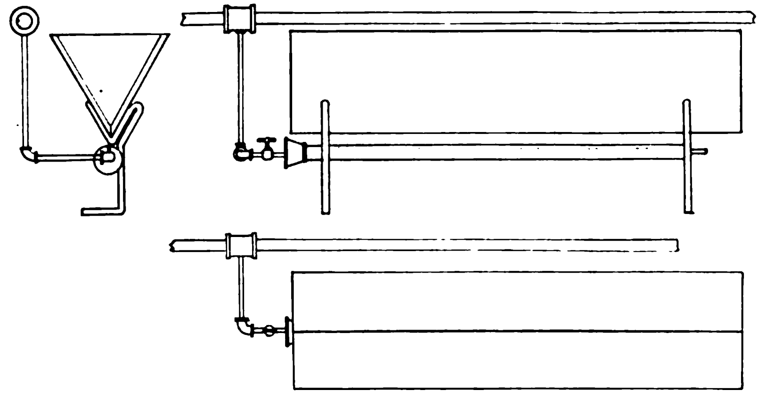
PERMANENT BARRICADE.

H. C. MORRIS, GEN. MANAGER, THE DALLAS GAS CO., DALLAS, TEXAS.

The sheet and photograph show an easily constructed permanent barricade; the small tripod in photograph shows a permanent method of posting permits, when same are required to be posted on job.



Wrinkle No. 146.



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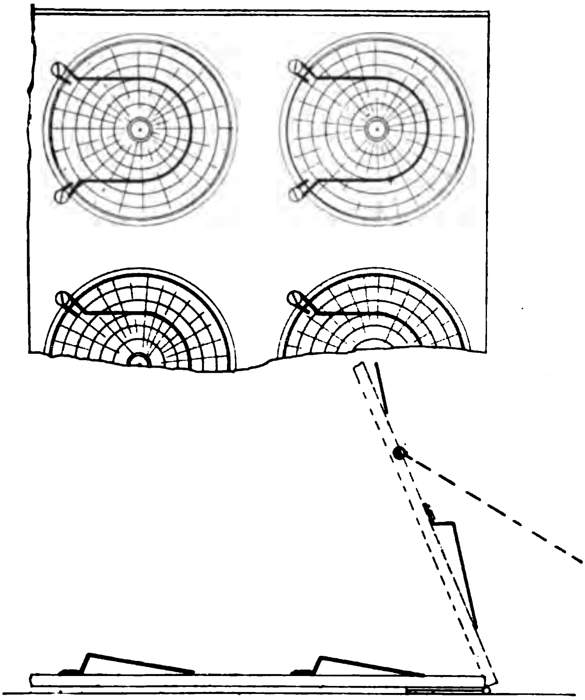
Wrinkle No. 147.



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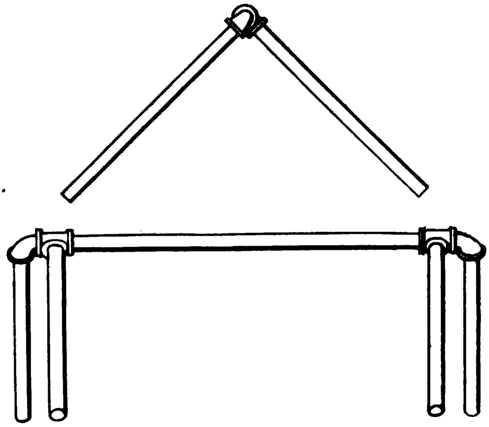
Wrinkle No. 148.



Wrinkle No. 148

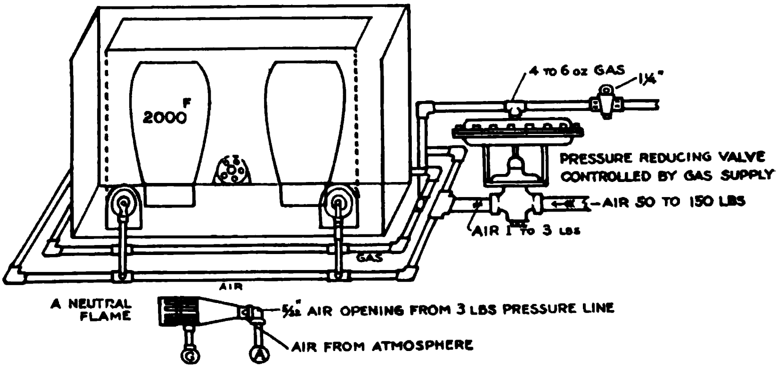
WRINKLE NO. 149.

GAS BURNERS AND CONTROL FOR CRUCIBLES

E. C. Merrill, Gas Engineer, Pittsburgh, Pa.

I am showing herewith a sketch showing a system of Gas Burning and controls that has been in use for 12 months or more.

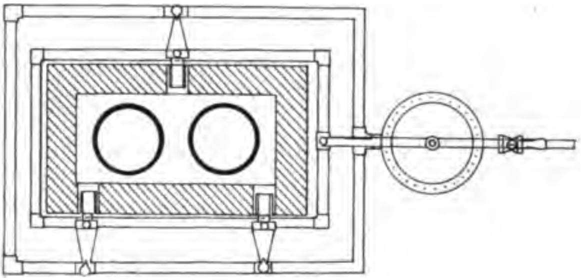
The furnace is used to heat crucibles before the steel is poured into them.



Wrinkle No. 149.

The specifications guarantee 2000° F with a Gas Economy that cannot, in our judgment, be materially improved in this style of Furnace.

There is no chimney used. The valve is of our devising and has two functions.



Wrinkle No. 149.

WRINKLE NO. 150.

ALL TAPS ON HIGH PRESSURE LINES MUST BE PROPERLY INSTALLED

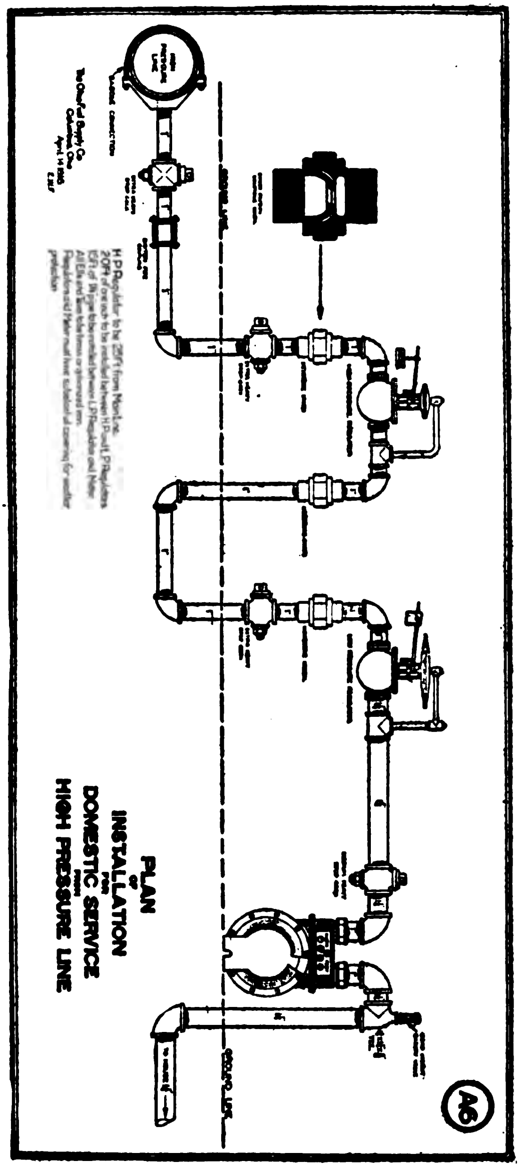
H. H. HALL AND GEORGE OFFENBAKER, THE OHIO FUEL SUPPLY CO., COLUMBUS, O.

Herewith we submit a copy of drawing showing plan for installing domestic service from high pressure lines. When application for gas is granted we furnish the prospective consumer or his plumber with a copy of this drawing, showing just how we want the regulators and meter to be set.

As the drawing is made to explain the entire installation, we submit it as it is.

One interesting point to gas men is that the blow-off valve is on the consumer's side of the meter. It will also be noted that high pressure fittings are specified on the high pressure side.

The unions on the high pressure regulator are set in an upright position. This allows us to easily lift off the regulator for repairs.



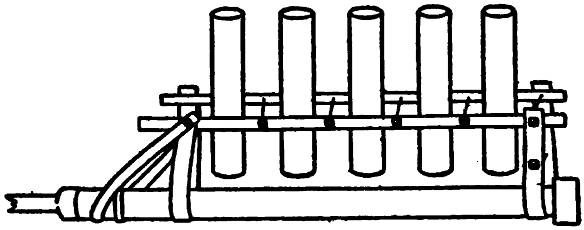
Wrinkle No. 150.

WRINKLE NO. 151.

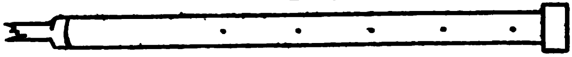
INSTALLING BURNERS WITHOUT BRASS MIXERS.

T. J. Thatcher, Foreman, New Business Department, The Ohio Fuel Supply Co., Columbus, Ohio.

For fitting up a coal boiler with burners, we have recently devised a method of installation that is a considerable money-saver, especially now that brass goods are worth their weight in gold. The brass mixers are also easily broken in handling.



No 1 — Showing how tubes are held in place



No 2 — Showing how orifices are drilled in header

Wrinkle No. 151.

The usual method for making tube installations is to use, say 1½" pipe tubes, with 1½ x ½" brass mixers, tees and nipples on the header pipe.

Our method is to simply drill 3/32" holes in the header pipe, and fasten the tubes, without mixers, just over the 3/32" orifices by means of strips of strap iron, as shown in the rough drawing. We find they work at least as well as with the mixers. There is a saving in labor and material, and the air and gas adjustment cannot be changed by well-meaning meddlers.

REPORT OF THE COMMITTEE ON AWARDS FOR THE WRINKLE DEPARTMENT.

(After the Meeting had adjourned, the following report was received by the Secretary.)

June 13, 1916.

T. C. JONES, *Sec.*,
Natural Gas Association of America,
Delaware, Ohio.

DEAR MR. JONES:—

The committee on awards for the Wrinkle Department have had several meetings and have experienced a great deal of difficulty in deciding to whom the awards should be given on account of the large number of wrinkles submitted and the variety of uses and purposes for which the Wrinkles would be useful. Prizes might have been awarded to a number of other wrinkles other than those to which the awards were finally given. The winners are as follows: —

1st Prize for best Wrinkle to E. D. Ivory, Industrial Department, Peoples Natural Gas Co., Pittsburgh, Pa., for Wrinkle No. 110.

2nd Prize to H. H. Hall & George Offenbaker, The Ohio Fuel Supply Co., Columbus, Ohio, for Wrinkle No. 150.

3rd Prize to G. W. Pemberton, Line Walker, Lone Star Gas Co., Irving, Texas, for Wrinkle No. 11.

4th Prize to Jos. P. Delaney, Union Gas & Electric Co., Cincinnati, Ohio.

5th Prize to J. R. Gilbert, Fort Worth Gas Co., Fort Worth, Texas.

Respectfully submitted,
F. W. STONE,
JAS. P. STRICKLER,
A. P. DAVIS,
Committee.

Mr. John M. Garard: Mr. President, before making the motion I have in mind, and referring to the remarks of Mr. Shannon, the Assistant Editor, I desire to say that I happen to be the manager of one of those small concerns, but I do not propose to lay under the charge suggested by Mr. Shannon. I desire to enter a plea, "Not Guilty." Gentlemen, I am innocent, although I suppose I am the only man in the house that is. (Laughter). I believe I can prove by Mr. Brown, the Editor of this Department, that I went to our men all over the field and tried in every way I could to bring about the results we have here. I do not want to take any feathers from their bonnets because I know they are entitled to all of the thanks that this Association can extend for the diligent and capable way in which they have handled the Department. Having thus established my alibi, I now desire, Mr. President, to move that a hearty vote of thanks be tendered to the Editor and the Assistant Editor of the Wrinkle Department for the very excellent work performed by them, and for the excellent results obtained by them in the conduct of this department.

Mr. Kay C. Krick: I take great pleasure in seconding the motion.

Secretary Jones: Mr. President, before putting that motion I beg to announce that the Directors have passed a resolution authorizing the publication of three thousand separate copies of the Wrinkle Department, and they will be distributed to companies or anybody else at the rate of twenty-five cents a copy.

President Cartwright: The Secretary will be glad to take your orders at any time before you leave the Convention. Are you ready for the question?

The above motion having been duly seconded, was then unanimously adopted.

President Cartwright: That finishes the regular program of the day, and the Chair will now be glad to entertain a motion to adjourn. Before that motion is made, however, I desire to urge upon all of you that you be here promptly at ten o'clock tomorrow morning. We are going to have a very interesting program tomorrow. Arrangements have been made so that the sessions will not be dragged out. They will not be very long. There are many interesting papers, and we hope to have many spirited discussions on the important subjects contained in tomorrow's program. Therefore I again urge upon each member to see to it that he is here promptly at ten o'clock for we expect to begin at that time, and we must conserve our time in order to get through with the program. The Chair will now entertain a motion to adjourn.

On motion duly made, seconded and carried, the Association then adjourned until Wednesday, May 17th, 1916, at ten o'clock A. M.

SECOND DAY — MORNING SESSION.

Wednesday, May 17th, 1916.

President Cartwright: The Convention will please come to order. I would like to suggest during the reading of these papers — the hall being none the best for hearing — that the members refrain from going out during the reading and during the discussions. I would also like to urge that you members representing different companies here insist upon your men attending these meetings. We have twelve or thirteen hundred members and yet here we have a mere handful this morning. While we are very glad to have all of the members of the Association visit the Exhibit Hall, at the same time there is no necessity in them being over there all the time. You come here representing different companies and as individuals to attend the meetings of this Association. This is the important work here, and I think it is up to all you representatives of different companies to insist that your men attend these meetings, attend them regularly and stay all through the sessions. We are cutting the meetings as short as we can to get through with the work we have before us. We should have at least six hundred members present here this morning. Instead of that we have barely a few hundred. It is the "Old Guard" that is here. A lot of the new members are over in the exhibit hall when they should be here, and I hope this afternoon there will be a considerable improvement in the attendance.

We will now proceed with the regular program. The first paper this morning is on the subject of "Welding in Gas Main Construction," by Mr. Frank L. Hadley. Mr. Hadley, the gentleman who wrote this paper, and who occupies a responsible position with the Peoples Gas Company, was called away to do some work down East, and is therefore unable to be here to read to us this paper upon this very important subject this morning. Mr. Abbey, Chief Engineer, has very kindly agreed to read the paper for Mr. Hadley, and no doubt will be glad to answer any questions which he may be called upon to answer during the discussion of the paper. I will now call upon Mr. Abbey to read Mr. Hadley's paper.

Mr. Walter Abbey, Jr., Chief Engineer, Peoples Gas Company, Pittsburgh, Pa., then read the following paper:

WELDING IN GAS MAIN CONSTRUCTION.

F. L. HADLEY.

The subject which is treated in this paper is one which has become of great interest to all gas men and especially so to those interested in the construction and maintenance of lines and the transportation of natural gas from the field to the different markets.

From what we now know of the Oxy-Acetylene method of welding pipes together it appears as if the ideal method of constructing natural gas mains has been discovered and that it will mean as great a boom to the natural gas industry of the future as the discovery of the coupling was to the past, and while it is true that this method may not lead to the building of as many long lines to reach distant markets as did the development of couplings used in connection with plain end pipe, yet it will mean that the leakage as being one of the principal factors in the transportation of gas will be practically eliminated, effecting a saving of many thousand dollars annually to all of the large gas companies, besides giving us cheaper lines to build and operate.

This method of laying lines has been tried out very extensively by artificial gas companies during the past few years and in all cases of which we have knowledge it has been found to be very successful both in economy and in securing good tight lines. Some of the eastern companies are now welding all their extensions including the mains and service lines down to ¾" pipe. At the time which this paper is written the writer is engaged in installing such a plant which will consist of 14 miles of 8", 9 miles of 6" and approximately 10 miles of smaller pipe together with several hundred service lines of ¾" pipe all of which is to be welded, it being our intention to complete the entire plant without the use of a single fitting of any kind, with the exception of valves and stop cocks.

The writer desires to give his experiences in building approximately seven and one-half miles of 10" line during last fall on which this method of joining the pipe was used in place of couplings or collars. This line was laid through rolling country with the highest hills of probably 300 feet being in some sections somewhat rough with a number of small ravines. The pipe used was standard 10" I. D. line pipe furnished in long lengths which averaged about 35 feet to the joint. In order to facilitate the welding we had the ends of the joints chamfered or beveled at an angle of 60 degrees which was done in the pipe mills without extra charge. By having the pipe thus chamfered the welder was able to start welding at once after the joints were lined up, otherwise it would be necessary that he melt down the edges of the pipe with the flame to secure a foundation before he would be able to start welding.

Heretofore in laying welded pipe we found that it was customary to lay the pipe in sections along the ditch and by turning the joints by means of tongs to allow the welding to be done on top of the pipe. We decided to make a little departure from this method and wherever the ground was suitable we laid the pipe joint by joint directly over the trench and did the welding without turning the pipe. While the welding was somewhat slower by reason of it being necessary to weld underneath the pipe, we found that we gained time in the end as we were able to slack the pipe directly into the ditch after the welds were made and to make the bends the same as if we were laying screw pipe; that is by building fires and heating the pipe wherever it was found necessary to place a bend.

Owing to the rough character of the ground we were obliged to make a great number of these bends but in nearly all cases they were made as the welding progressed. In a few places we had men go ahead and make bends which were placed in the line when the welder came up but as a rule this was only to gain time in some certain rough section of ground.

In testing out this line we used 100 pounds of gas pressure from one of our compressor stations and when completed was found tight with the exception of 5 leaks which were very small being nothing more than little pin holes in the welds. These leaks can be easily repaired by placing additional metal upon the weld after the pressure has been taken off from the line.

During the laying of the line we subjected it to many severe tests in order to find out the strength of the welds and in only one case were we able to break them. For instance we would hold the pipe up to the top of the trench with one of the wooden horses and lower it into the ditch on both sides of the horse, then we would suddenly let go of the pipe and allow it to fall without any support to the bottom of the trench, then at other times we would leave 5 or 6 joints swinging in order to test the strength of the weld. We would make the bends in some cases nearly at the weld but at no time did we have any trouble with them not holding although the strain was very great where the bends were made without the line being blocked or braced. In fact we tried out the strength of the welds in every possible way in order to find out if there were any weak points in the construction of a welded line. In other words we did not want to give up the idea of welding our lines in the future unless it was proven to us that it was not practicable.

This one break which we had during the building of the line was caused by a poor weld, the pipe not being perfectly joined together although at a casual glance it had the appearance of being as strong as any of the other welds yet upon a more careful examination we found that the two pipes had been simply tacked together with metal and the iron melted in between them without being united and making a continuous pipe. Fortunately for us the welder who made this weld was discovered in time otherwise we might have had more trouble with defective welds.

Before and during the building of this line there was considerable discussion as to the contraction and expansion on a welded line of this length many holding that the line would pull apart at the welds owing to the contraction and expansion that they expected we would find on a line such as we were laying with only 20" of covering that being the depth which we were having it buried. However we did nothing to take care of this as we took it for granted that the pipe itself would take care of any contraction or expansion that there might be. In other words, we figured that when the line was finished we would have one continuous joint of pipe the same as if we had secured a seven mile length from the mill and if it had been possible to secure such a joint of pipe nobody would have thought it necessary to have it cut and expansion joints or sleeves put in. In this connection I can advise you that we have not had the slightest trouble with the line pulling apart although there has been some severe cold weather since the line was put in commission. There have been two breaks, the first one shortly after the gas was turned into the line, which upon examination showed plainly that it came from a defective weld in which the pipe had the appearance of being burnt. The other break was caused by a sink in the surface of the ground at a coal mine and was a break which would have occurred on any line under like circumstances. Neither of these breaks showed any signs of there being contraction of the pipe although the break at the mine took place during very cold weather. To secure welders we were obliged to pay a rate somewhat higher than the regular rate yet with this high cost of labor the cost of the welds came slightly under the price of standard couplings such as is generally used on like lines, but this being our first experience in this kind of main line construction our costs were likely greater than they would have been had our experience been more extensive. I believe that a welded line can be laid with such economy that the cost of the joints will not be over two-thirds of what it would be if couplings were used.

It might be of interest to the members of the association to know that during the time which we were engaged in laying the line above mentioned that we tried out Oxy-Acetylene welding on casing at one of our wells known as the R. A. Geary well or as it is more commonly known now, "The Deep Well." This well on which we began work in November, 1911, is located about 4 miles out of McDonald, Pa., and at the time this paper was written had reached a depth of 7,181 feet being by far the deepest well ever drilled in this country and only exceeded by one other well in the world. At the time of which I write we had in in the well a string of 3½" I. D. or 4½" O. D. casing 6,320 feet long with heavy collars. In order to use a larger sized casing it was decided to pull out the screw pipe and run in a string of 5" with welded joints. The casing was furnished in 21 to 23-foot lengths, the first two thousand feet being 5" O. D. or 4.29" I. D., .355 inches thick weighing 17.611 pounds per foot. Owing to the fact that there was an enormous water pressure on the lower casing it was heavier than that used above the water which was 5" O. D. or 4.24" I. D., .288 inches thick weighing 14.493 pounds per foot there being 4,320 feet of this or a total length of 6,320 feet in the string. On both weights the ends of the joints were chamfered 60 degrees. In placing the casing in the well there were two joints welded together outside of the derrick, then after the welding was completed these were placed in the hole and lowered down until only about five feet remained above the derrick floor. Then two additional lengths were welded together in the yard as before and then brought into the derrick, raised and suspended in the air with the lower chamfered end resting upon the upper chamfer of the section previously placed in the well, then the welder proceeded to weld these sections together vertically after which they were lowered into the hole. In order to sustain as much of the weight as possible during the time that the casing was put in, a shoe was placed in the casing, this being an oak plug about 3 feet long which was driven into the end of the first joint. It was the intention to drill this plug out after the casing had been placed but when about one-half mile of pipe had been lowered into the hole the pressure of the water was so great that the plug blew out with great force. After this happened a second plug was placed in the next section, this plug likewise was of wood but it also had a steel ring back of it. When all the casing had been placed in the well this plug was drilled out leaving the casing free. When you realize that this string of pipe 6,320 feet long with a weight of over 48 tons was to a great extent held by the last weld it will give you a very good idea of the strength of a properly made weld. Before closing, I might say that we exercised great care in being sure that more metal was used at the weld than there was in the pipe itself. On this line we made it a point to have at least one-sixteenth of an inch more and on the casing somewhat more probably one-eighth to three-sixteenths of an inch. The strength of the weld depends wholly upon the amount of metal used and the care taken in welding the two together.

DISCUSSION.

PRESIDENT CARTWRIGHT: Gentlemen, few innovations that have been attempted in the natural gas industry will be more revolutionary than this welding process if it is a success. I certainly would think that the millennium was at least approaching for the natural gas man if we could look forward to a trunk line or other line free from leaks and free from any breakage. It is a very interesting and certainly a very important subject, which has been treated here in a very practical way by Mr. Hadley, and I would like to call upon some of these men who have had wide experience in this line of construction.

Mr. Gallagher, will you give us the benefit of any suggestions you may have arising from your experience in connection with the welding process in gas main construction.

Mr. R. W. Gallagher:

Mr. President, and Gentlemen: This is a very interesting subject, especially to anyone who has considerable to do with trunk line construction, as well as city work, particularly so if lines are laid through rough country. I am inclined to think that we have all been somewhat skeptical on the subject of welding in gas main construction, perhaps to the same extent as we have been about everything else that has been tried, until proven to be practicable from actual experience. This was true about couplings in the early days.

The various phases of the problem which Mr. Hadley brings out are very interesting and bring up questions that we have all thought a great deal about. The matter of contraction and expansion is one of the important problems, as well as the manner in which the pipes are to be welded and placed in the trench.

One of the great problems in cities with all gas companies is the kind of construction to have under pavement. The rubber joint line as we all know has its drawbacks, especially where there is considerable construction work being done, such as sewer construction before or after the line is laid, and previous to the paving. For instance, a line is laid in a street and the sewer contractor comes along under a contract with a municipality to put in a sewer some eighteen or twenty feet deep. Sheeting is used for the purpose of constructing the sewer, and after the sewer is completed the dirt is dumped back into the ditch without taking any precaution to prevent settlement, and the sheeting immediately pulled. In a great many cases it has been found that the dirt in the whole street has settled, and in the laying of gas mains in these streets, presents a very serious problem to the gas engineer. This sewer construction generally comes just previous to the improvement of a street. By improvement I mean the paving of the street. After the street is paved the ordinary exit for gas is cut off, especially in the winter, when the ground on both sides of the pavement is frozen. This is one place — of all others — where the welded line is going to be a wonderful improvement and a great benefit to the natural gas industry. Especially is that true, as Mr. Abbey says, if it will withstand such strain as it was subjected to in connection with their test. If the welded line will withstand the strain incident to the settlement of dirt in restricted areas and eliminate danger of breakage, it is a process that will certainly prove to be a boon to the gas companies.

The welding process also appeals to us in connection with fittings. Take for example our own experience. Heretofore we had to carry a large stock of tees and other fittings to take care of the different classes and kinds of work. With the welding process we have been able to make our own fittings as we needed them, including a great many angle fittings. This obliviates the necessity of a large idle investment. No doubt our experience is the experience of other companies, as I understand there are a great many companies now using welding fittings.

As to the matter of expense it is very gratifying to learn the experience of the writer on that point, that is, compared with the ordinary screw or rubber joint fittings. I do not think of anything else, Mr. Chairman, to add to the very comprehensive and instructive paper which Mr. Hadley has prepared, and which Mr. Abbey has just read to us.

President Cartwright: I will call upon Mr. Sullivan to discuss this subject. I think he has had pretty wide experience in making fittings by this process. Tell us something, Mr. Sullivan, if you will as to the cost of these fittings as compared with the ordinary fitting.

Mr. T. O. Sullivan: The paper read by Mr. Abbey, I think covers the ground pretty fully in regard to the laying of welded pipe lines. I have had very little experience myself in constructing any long lengths of line by this process. Last fall, as an experiment, we laid about eighty joints of twelve inch pipe by the welded joint method, and we exercised a great deal of care in making these welds, building the joint up a little more than perhaps was necessary, but it being the first time we had tried it, we were extremely careful about it. After the line was constructed and put into use we tested with about eighty to ninety pounds pressure, and tested every joint with soap suds, and we did not have a leak on the entire eighty joints. At one point where we were constructing this line we had to cross under a railroad track where the ground on the lower side of the track fell away very rapidly from the track. We put the pipe in a casing and where it came from underneath the track we laid two joints — about forty feet — extending out into the air at the end of the forty feet, probably about ten feet above the solid ground. Then I put about six or eight men up on the end of that and had them endeavor to break the joint off where it came through under the railroad right close to where the casing stopped. In this way we tested the strength of the welded joint at that point and we found we could not break it. The pipe itself commenced to bend rather than breaking the joint, so that we felt very well satisfied that as far as strength is concerned it was probably as strong a joint as we could get. We have been using an outfit in our shop for making fittings and we find it of great advantage. I think it saves us considerable money.

I am unable to give any exact figures as to cost for the reason that most of the work has been done at odd times when the men were not engaged in other work. As near as I can figure it the cost would be less than the regular fittings heretofore employed for such work. There are a great many advantages in using the process in that way as it gives an opportunity to use up odd lengths of pipe and if any special fittings are needed, odd angles or anything of that kind, they are very easily made in a very short time.

We have been using the process for making swage nipples by inserting one pipe into the other and welding them, and it has worked very successfully. I can not see any reason why lines could not be constructed by the use of this process and probably done as cheaply as any other way, and certainly in the matter of leakage there would be a great saving.

PRESIDENT CARTWRIGHT: The Chair would like to ask Mr. Abbey a question. What do you mean by chamfering? I presume that means swaging the pipe by beveling the ends?

MR. WALTER ABBEY, JR: A chamfered end means the cutting of the edge off at a bevel, cutting the end down into a bevel edge, so that when the two joints are butted together you have a "V" shaped end where the two joints come together. In that way the welder is able to get down to the very inside of the pipe to start his welding, and his welding starts at the inside of the pipe and he builds it out, this making a tight joint all the way through, instead of just joining it on the outside and welding it in that way, which would happen if they used a butt weld and a square end.

PRESIDENT CARTWRIGHT: How long does it take to weld a ten inch joint or a ten inch weld?

Mr. Walter Abbey, Jr.: For a ten inch weld it takes about a half hour to make the weld and make it properly, and it uses about twenty-six or twenty-seven feet of gas. It takes a little more acetylene probably than it does of oxygen. I get these figures from the oxy-acetylene people who very kindly gave me all the information I asked for.

President Cartwright: Have you made any experiments in the use of natural gas for welding purposes?

Mr. Walter Abbey, Jr.: We have made some experiments with natural gas welding and find it very satisfactory. I do not believe that you can weld as thick stuff with natural gas as you can with acetylene. It does not seem to have the heat value that acetylene gas, but it does weld light stuff very satisfactorily and makes a good joint. If you put two pieces of pipe together and grind them down you cannot tell where the weld starts and ends or where the pipe starts and where the weld ends. There is no line in there at all.

President Cartwright: In using natural gas is there any treatment necessary, or do you simply use the natural gas as it comes from the ground, the same as you do oxy-acetylene?

Mr. Walter Abbey, Jr.: You can not use the same burner. You do not get the same results with the same burner. It seems that the oxygen must be mixed with the gas a little farther back in the burner.

President Cartwright: You do mix oxygen with the natural gas, then?

Mr. Walter Abbey, Jr.: You use natural gas, but you have to use the oxygen with it to get the heat to give you complete combustion.

President Cartwright: Gentlemen, have you anything further to ask Mr. Abbey, or is there any further discussion upon this subject?

Mr. J. C. McDowell: I would like to ask Mr. Abbey, how long did it take to weld that seven and a half miles of ten inch pipe?

Mr. Walter Abbey, Jr.: I am not prepared to say that. Mr. Hadley laid the line. I am not sure how long it did take to lay it. I know that we were not so very long on it, though.

MR. J. C. MCDOWELL: Do you know how much can be laid in a day?

MR. WALTER ABBEY, JR.: No sir, I do not.

MR. J. C. MCDOWELL: Do I understand that it runs about a half an hour to each joint?

MR. WALTER ABBEY, JR.: Approximately a half an hour to each joint, however.

MR. J. C. MCDOWELL: That is a point I have been seeking information upon. The companies with which I have been associated or connected have been doing a large amount of this work by means of this welding process, and Mr. Diescher, who is present, has had more experience probably in the actual work than any other man that I know of. Just a word now before I leave the subject, and then I would suggest that Mr. Diescher give the Association his experience along that line. I want to say this in regard to the contraction and expansion matter which has been touched upon. There need be no apprehension in that regard whatever. In order to give you the facts I must confess to having laid an eight inch line in 1880 and '81. That was before any line pipe larger than six inches was manufactured. That was a long time ago, when we laid a cast iron pipe because there was no pipe larger than six inches. They began then to lay larger pipe, and for many years — until late in the '90's, — no nipples were used. It was thread pipe altogether. During this time I was laying many hundreds of miles of line, six, eight and ten inches, not anything larger than a ten inch line, and where the line was properly laid we never took into account the matter of contraction and expansion, or the matter of the use of expansion joints at all. In fact we discountenanced expansion joints practically altogether. In a thirty-six inch line which was re-laid and which is now in use for the Philadelphia Company extending from this city southward, — a thirty-six inch riveted field line, the expansion joint was of unusual type, not the ordinary type, because the expansion joint where it passes through the rubber changing back and forth was found not to be efficient. It would not hold. So that the matter of contraction and expansion can be dismissed from your mind. I am very hopeful that this new process of welding will solve many of our difficulties, but there are a great many problems yet to be worked out. We all know how important it is, sometimes, to get in under the line quickly where there is a break in the line to make a change in the connection in case of accident or something of that character. Now, I have some anxiety about putting these cutting machines in the line which is partly filled with gas and am somewhat fearful of disastrous results, but all of these things will have to be worked out. With a coupling connection you can handle the situation with comparative safety, and do it quickly, but with the welded joint much more caution must be exercised. However, all of these things will have to be taken into consideration and no doubt all of these various problems will be ultimately solved and solved satisfactorily. There is no question in my mind but that in the course of time they will all be worked out.

PRESIDENT CARTWRIGHT: We will be glad to hear from Mr. Diescher.

MR. A. J. DIESCHER: We have had experience in laying approximately fifty miles of welded lines ranging in size from four inch to sixteen inch in diameter. There were single stretches of six inch line as long as eight miles, and we have one ten inch line nine miles long, in a single piece. In addition to this, we have sixteen inch and eighteen inch lines welded up in short lengths; say several hundred feet, between our compressors and our after-coolers. At several of our stations, we have our after-coolers welded at every collar. Some of these have several miles of four inch pipe, and leaks would appear very readily under the water. We find most of the leaks in the cooler at the few flanged joints remaining. The troubles found in welding, as pointed out in the paper read, are similar to those which we experience in our work. We find quite a number of small pin holes occurring in welding. These are discovered upon testing the line to pressure. We find them to occur more often when we use Norway iron as a welding material, and less often when we use Vanadium steel. The temperature of the flame has considerable to do with this, as any tendency to burn the iron will result in spongy welds. The proper selection of welding material and careful observation to avoid burning the iron in welding, will tend to reduce the pin holes.

We have had a number of welds pull apart just the same as reported by Mr. Hadley in his paper. However, all such instances which we have had were in defective welds, and occurring prior to our giving the line its final test after construction. We have had no trouble from breaking after the final test, and have had very little, if any, trouble from expansion and contraction.

Where lines are put into service prior to testing them for high pressure, a few defective welds pulled apart. However, there are very few such cases, and none serious. We subjected these lines to pressures as high as 400 pounds, but our usual working pressure is 300 to 350 pounds on most of them.

Now, as to contraction and expansion, it must be admitted that a welded line is at no disadvantage in this respect over a screw line. Whether the joints are screwed together into one rigid line, or whether they are welded together, is all the same as long as the line is one continuous piece. There should be no greater troubles from contraction and expansion in the welded line than in the screw line.

We have adopted different methods of laying to suit the conditions at the time the work is done. Where we desire speed, we increase the number of welding crews. Each crew welds five joints into one string of about 100 foot lengths, and upon completion of this, they move forward to the next five joints to be welded. Sometimes we carry as high as eight of these crews. They are followed by another crew who roll the 100 foot lengths out over the trench, and butt the ends of the string up against the end of the welded line, and they weld the strings together about every 100 feet. On small pipe this can be done over the trench, and on large pipe it is advisable to do it in the trench, digging a large bell hole for convenient access. I see no reason why, by putting in a large enough crew, we cannot lay welded lines as rapidly as screw lines or coupler lines.

In welding six inch line, under normal conditions in our country, rolling prairie land, we count on about 25 welds per crew, although I stood over and watched the men weld six inch pipe, taking the time from the start of one weld to the start of another, in fifteen to twenty minutes. However, that would not be an average for a day's work. On sixteen inch pipe our best welders weld about eight joints in a day. However, we consider six joints as a fair average day's work per crew of two men.

As to the welders, we have found it necessary to train our own men. These men have later been put out as foremen over the gangs, and we have had fair work by training the Bulgarians from the trench to do the welding. We prefer the American welder when we can get him. It generally takes a couple of days to train a man for welding, if carefully superintended. The progress of the work and the success of it is largely dependent upon the energy and ability of the foreman in charge.

In our Cushing compressor station we have no fittings whatever from the outlet of the station building through the headers, coolers and absorption plant to the main line, excepting gate valves and companion flanges at the gate valves. These coolers consist of two sixteen inch discharge headers, paralleling the station building. They split into four eight-inch lines which run through the cooler, which is a right angle in shape, being a bend in each eight inch pipe. There are instances where the welds occur on the bends, but they give satisfactory service as elsewhere. The welds at the bends were made just the same as the other welds, and no extra attention given them. This station is running at 350 to 360 pounds discharge pressure. The ends of the headers have no flanges, but are welded shut with a piece of sheet steel welded into the end.

We have laid lines in both summer and winter. We aim, however, to lay our main lines during the cool weather, so as to reduce the effect of contraction. We feel that by laying the line in hot weather, when it has expanded before being put into the ground, there is far greater danger of contraction, strain and breakage, than when laid in cold weather, but prefer to lay the line in the colder weather when it has contracted prior to being put into the ground, and the main change which would occur through contraction and expansion would rather being expansion, the ground tending to hold the pipe in place, while with contraction the ground does not offer the resistance and support to a shrinking line that it does to an enlarging line. We have laid lines in the middle of the summer, and after a year's operation we have had just as good results from these lines as those laid in the winter time. However, our larger lines have been laid in the cool of the fall and in the cold of the winter. We believe it well to observe these points as far as possible, as a matter of safety.

At the present time we are contemplating the construction of twenty-five miles of 12 inch line in one stretch, welding at every joint. This will be for 300 pounds working pressure.

Based upon the results of our investigation and experience, we feel that the welded line is bound to be the line of the future. There are some problems to be solved. There are a number of points to be guarded against, which in time will be no doubt satisfactorily solved. We do not believe it wise to heedlessly go into the laying of the larger lines, especially for high pressures, but do think it wiser to gradually build up to these sizes, and meeting and solving the new problems which they entail, rather than to jump into it and have poor results, and possibly failure.

MR. M. W. WALSH: I would like to ask how many men are there in a crew, ordinarily?

MR. A. J. DIESCHER: We have two men to a crew, and where we use a considerable number we can cut it down to less than two by making one man serve two welders.

MR. R. S. LORD: In reference to the point of how many welds are ordinarily made, I would like to ask Mr. Diescher how many he expects to be made on a ten inch line in a given length of time.

MR. A. J. DIESCHER: On a ten inch line I would not expect a man to lay more than about eight or ten welds a day.

MR. R. S. LORD: Unfortunately, I did not hear all of the paper, but being in the business of welding pipe lines from the contractor's point of view, and having had a wide experience in recent times on that matter, I just wanted to point a word of caution in that respect. When you speak of eight welds a day, of course that is not on the basis of a half hour per weld; and

I am afraid that some of our friends, who are selling outfits for welding, are a little over-optimistic as to the rate of speed at which this welding can be done. I noticed — I think it was the reader of the paper, who stated that he thought these welds could be made cheaper than the couplings. As most of you know, I represent a Company in the coupling business, and I also represent a Company in the pipe laying business, and we are in the business of laying pipe lines, regardless of how they may be laid. We lay them screw joints or coupler joints, without regard to whose make of coupler it is; and we also lay them with weldings, having already completed quite a number of welded lines, and having under contract and construction at the present time large lines in Illinois, and also in Arkansas; but we do not find that the welded lines so far is the cheaper line of the two. I will agree with the last speaker, although I am in the coupling business, yet I think the welded line is the line of the future. There are many things, however, yet to be learned. There is more trouble in the matter of pin holes and such matters as that than is commonly represented. We have had our fingers burned a few times in the past, and we know what we are doing in that respect. We have several jobs under construction, and a number of skilled men, not only in our shop work where we are doing welding right along, but also out in the field. I believe it is a mistake to think that a joint can be properly welded in thirty minutes, or that that can be made sort of an average "stunt." We bought some new outfits lately. We have been trying all the different makes in order to find out if there is any great difference in the different instruments and appliances employed. We have not yet solved the problem as to whether one man's work is better than another's. Representatives of one of these Companies have sent for us to demonstrate his instrument. It seems that he is connected with a concern that does a great deal of welding. I have talked with the man about the matter of the consumption of time, and he agreed with me that these tests, just as Mr. Diescher says, of eleven minutes and eighteen minutes and thirty minutes, are not what may be considered as an average. The welding process is a good thing, no doubt, and undoubtedly will be a good thing for the future, but we may consider that there are difficulties which only skill and experience may overcome, and while we can pick up a man and train him under proper supervision and put him to work and have him learn to weld the pipe together in a short time, yet we have had a great many men work at it for weeks and weeks and still they are not successful. There is room for more skill in this class of pipe laying than any other line that has ever been handled in the past, and I believe, while it is a matter of the future, yet it is not a matter that just every Tom, Dick and Harry can start right in at today and lay a pipe line without proper experience and skill. I want to refer to one place in particular, without mentioning just what the case is: We were bidding on a construction job at what we considered a fair price, and in that price we figured that we could better afford to furnish certain couplings, where we were given the privilege of furnishing the coupler on a ten inch line rather than do the work. In other words, it was cheaper for us to furnish the couplings than it was to do the work. We contractors know that you cannot put the pipe together as cheaply as we can couple it together. So we were permitted to do that. Now, near the same place was another contract for a ten inch line. We bid on that, what we considered a reasonable figure, but one of the parties who were interested in selling instruments gave these people to understand it was merely a "snap" to stick the pipe together, and they employed a local contractor, who I understand had never had anything to do with pipe line construction or welding, and he bought the instruments and went at it. The work is not done, but I am inclined to think the Gas Company and the contractor will both learn something before they get through.

Mr. Charles Craft: I would like to ask, with reference to the life of the pipe and the recovery and reclaiming of the pipe in case of a welded line. What about the pipe in case the gas gives out in a short time? Could this pipe be reclaimed, if a welded line were used? It might be of benefit to the Association to know what is to become of the pipe in a case of that kind. If the line were expected to remain for 25 of 30 years, as in the case of an artificial line, it might be a good proposition. But for six or seven years, would it be as cheap to weld our pipe, as to put couplings on it? I just thought I would mention that situation, and ask what experience has shown in that regard.

President Cartwright: Mr. Abbey, Can you answer that?

Mr. Walter Abbey, Jr.; I don't believe I could answer that.

President Cartwright: Mr. Diescher, can you answer that question?

Mr. A. J. Diescher: I do not see that the welding has any bearing, or any material bearing, on the future value of the pipe. It is a very simple matter to cut the pipe and take it out in whatever lengths you desire. This can be cut with the torch more rapidly than by any other means of cutting pipe yet devised. We can take up a welded line and relay it as often as we please. There is nothing to prevent relaying it with couplers if desired; and if the pipe is thick enough to thread, it can be threaded and used in that way. However, it can be used over as often as desired by rewelding. We use a great amount of second hand pipe in our welding work, pipe which has laid in the ground for years. The rust and age of the pipe has nothing to do with its welding qualities, and the fact that it was once laid welded, does not make it unfit for other service if taken up.

In welding the pipe, the two ends are butted together. They need not fit exactly. If they are one-sixteenth of an inch apart, it will do no harm. The first step is to melt down the sharp corners at the joints, and make a V shaped slot around the ends of the two pipe where they butt, filling this V slot up with the welding material, as Norway iron or Vanadium steel, which comes in about one-quarter inch diameter rods or larger.

New pipe from the mills have the ends beveled to provide for this V shaped slot. However, it does not materially add to the time of laying the pipe when the slot must be melted down in the course of the welding. So I say that of itself would have no material bearing upon the value of the pipe, or the life of it.

A Member: I would like to know how you turn this pipe over to cut it. Also, I would like to inquire whether you can cut it with a welding torch.

Mr. A. J. Diescher: Yes. You can cut one thickness at a time. You can cut it from underneath, just the same as you weld it underneath. You can cut it in 100 feet lengths, or any length you want.

It is not necessary to turn the pipe after you cut it, neither is it necessary to turn it over to weld it.

The welds are made underneath the pipe, as well as on top of it. In cutting it, the flame from the cutting torch passes through the wall of the pipe, and all that is necessary is to pass the torch underneath the pipe as well as over it, and all around it, to cut the joints. This method of cutting is very rapid, and can be done either at the point of the weld or at any other point along the pipe, and into such lengths as you desire.

Secretary Jones: Mr. President: I move a hearty vote of thanks be extended to Mr. Hadley for his very instructive paper, and also to Mr. Abbey for his kindness and courtesy in reading it.

Mr. K. C. Krick: I second the motion.

Mr. M. W. Walsh: Mr. President; before that motion is put I would like to ask one more question with reference to that deep well, and the substituting of welded casings for screw casings. How do you hold the pipe to keep the casings from dropping into the hole?

Mr. Walter Abbey, Jr.: I am not sure about that. This particular piece of work referred to in the paper, was done under the supervision of Mr. Hadley, the author of the paper, and I had nothing particularly to do with that feature of the work. I did not get that information before I read the paper. However, I think Captain Wallace can answer the gentleman's question, if he is here.

Mr. H. A. Wallace: Usually it is held by a ring and slip, — commonly known as a ring and a slip, or spider and skip.

Mr. John H. Williams: In regard to the cutting of this welded line, by means of a welding apparatus, it has occurred to me, that it would be dangerous in regard to gas fumes remaining in the line. If there is any one who can give any advice in regard to that, I would be glad to hear it? Also, I would like to ask, as to whether it would be more advantageous to take up the line and cut it and re-weld both sides — top and bottom, without turning the pipe?

President Cartwright: Gentlemen, I rather believe these are problems that will have to be worked out in due course of time, by the natural development of this process of pipe line construction. As has been pointed out, not only in the paper, but, also, by the gentlemen who have discussed it, this welding process is still in a state of development and there is a great deal to learn about it. I believe, that those are things that will have to be worked out. In many instances, you will have to work out your own salvation in connection with it. As Mr. McDowell suggested a few moments ago, we all have a great deal to learn about this important subject. There is no question, but that it is a highly important subject and with the usual industry and enthusiasm, with which the gas man goes about for the solution of a problem, there is no doubt, in the near future this process will be developed to a state of perfection not yet attained.

Mr. J. C. McDowell: I do not assume that the writer of this paper meant in describing this welded casing to recommend the practicability of welded casings in wells, but, simply to illustrate the very great strength of the weld. Those of us who are familiar with the operations of wells, can readily see that many difficulties would arise in attempting to use welded casings, instead of the ordinary casings heretofore employed.

President Cartwright: If there are no further questions and no further discussion, I will now put Mr. Jones' motion, which I believe was duly seconded.

And thereupon on motion duly made, seconded and carried, a vote of thanks was extended to Mr. Frank L. Hadley, for the very interesting and instructive paper and to Mr. Walter Abbey, Jr., for reading the same.

President Cartwright: The next paper will be on the subject, "New Business For Natural Gas Companies And How To Obtain It," by Mr. Henry O. Loebell.

Mr. Henry O. Loebell: Mr. Chairman and Gentlemen: Doctor Manning in the splendid paper on Conservation of Natural Gas brought out a very important point in the opening part thereof, wherein he stated that conservation was sub-divided into three distinct fields. The operating field, the distribution field and the consumption field, as we may call it. Doctor Manning dwelt upon the importance of the conservation of the Natural Gas in the producing field. We have just heard a paper today by Mr. Hadley on the possibilities of decreasing the leakage in pipe line construction, by a new method of coupling, to-wit, the welding process. Probably, however, a great deal of the losses and leakages that occur in Natural Gas are right at the consumer's premises. Not leakage in the technical sense of the word, but the lack of efficient and proper appliances for the utilization of the gas. The value of a product is to be measured and ascertained at the point of consumption. Therefore, the economy with which gas is used at the home and at the factory, goes a great ways in determining the value of the product itself to the ultimate consumer.

The title of this paper has been chosen by the committee and probably books could be written on it. There is no man that has ever written a book, that covered the subject from every phase and I do not believe it is possible, as the problems must be met in different localities by different methods. I have made no attempt to prescribe, or even suggest a method, but, I have tried to discuss the fundamental reasons why a merchandising department is necessary in the Natural Gas business, and also to show that there are some fundamental reasons why and how we can obtain better rates and better values and have a better understanding with the people who are using our commodity, by the maintainance of a merchandising department properly and efficiently organized and carried out.

MR. HENRY O. LOEBELL, then read the following paper:

NEW BUSINESS FOR NATURAL GAS COMPANIES AND HOW TO OBTAIN IT.

HENRY O. LOEBELL.

The underlying principles which form the basis for successful modern merchandising methods are applicable to the sale of natural gas. The principles embodied in modern selling methods are the study of the market, the study of the commodities that come in competition with what one wishes to sell, and the study of the application of your commodity or the superior advantages your commodity offers to the consumer.

The difficulties that natural gas companies have experienced in the past have not been due to the lack of market for their product, but have been due to the lack of merchandising effort to secure the most profitable and most permanent business, as well as helping the customers to get the highest value out of the product they purchase. Merchandising methods have not been generally adopted because of the established customs in the business and the responsibilities that are attached to them.

Broadly speaking, every commodity, with the exception of water, enters in competition directly or indirectly with other commodities used for the same purpose. If your commodity is to receive preference over another commodity that it substitutes it must possess certain advantages. It is not necessary that the advantage be in cost, but it must be an item of sufficient importance to make the use of your commodity more desirable than any other. To be able to capitalize every conceivable factor of advantage in the use of natural gas, means increasing its value and its usefulness and establishing the business on a profitable and permanent basis.

The value of natural gas is not necessarily determined by the competitive cost of other fuels, but by its degree of usefulness. There is no human capable of visualizing a thousand cubic feet of gas and determining its value. *Its use is the only determining factor of its value;* and as the gas companies have no control over the uses which the gas they sell, is being put to, they naturally have no control over its value. That is, one of the reasons why the rates for natural gas are, to a large extent, determined by the cost of an equal amount of heat units in coal or oil. The idea is general that all fuels have an equal degree of usefulness. While this may be true in some industries, it certainly is not general enough to be accepted as the correct method of determining a competitive rate.

The burning of natural gas is sufficiently different from the burning of solid and liquid fuels to make its use an added advantage or a distinct disadvantage in almost every industry.

If we intend to extend its uses, increase our output and enhance its value, we must realize on the advantages and make them generally known and actively engage in eliminating the disadvantages that the use of natural gas may have.

APPLIANCES AND HEATING OPERATIONS.

The difficulties you will experience in the inauguration of a program that will help you secure more business at better rates, are the lack of properly trained men and the lack of efficient appliances.

As mentioned before the value of natural gas is determined by its degree of usefulness in the heating operation it performs. The efficiency of the appliance and the efficiency of the operation will determine the desirability of the fuel. A poorly constructed and arranged appliance, an appliance that is either too large or too small, will condemn the use of gas. On the other hand, an appliance that is well constructed and the proper size will recommend its use.

You may argue that the user should be sufficiently interested to see that the correct appliance is used. He is to a certain extent. He may be making knives or cement and treat his fuel problem as an incident in the process of manufacturing. He is not particularly interested in the burning of natural gas. While he may be interested in reducing his fuel costs, he has no means of specifically reducing the consumption of gas. With him the successful use of natural gas is an incident; with us it is our existence.

The appliance manufacturer has no incentive to build equipment specifically for the use of natural gas. Many adapt their equipment made for oil and coal to the use of natural gas and as long as no distinct effort is made by the gas company to influence development, the manufacturer will not spend money for experimenting to produce an appliance that is distinctly a natural gas appliance, and which develops the maximum possible efficiency.

We trust our commodity entirely too much for others to determine its value, when we could just as well supervise its use by expert heating men. Besides the function of helping our patrons to solve their heating problems, it would add a value to gas fuel with service, that no customer could afford to employ, but which would prove a paying investment to the company. This attitude would also influence the manufacturer of gas burning equipment to exert more ingenuity in perfecting appliances for the burning of natural gas.

There are industries in which natural gas adapts itself so well to the heating operation that much greater output, with much lower cost, is possible. In these industries the cost of gas should be credited with all the decreased items of expense and labor that would be necessary in the event that one would use another fuel in its stead. But this condition is not true of all heating operations and, due to the nature of the gas, much greater economies may be obtained with fuel oil, powdered coal, etc., especially in some industries where high temperatures are necessary; so that, in the event that a company is in a position to supply the entire fuel demand of a community in which a variety of industrial plants are located, it would find itself confronted with the fact that the competitive rates are not the same with the same fuel, used in different industries.

An illustration will probably make this point much clearer. In the ordinary steam boiler, the efficiency of a coal or gas operated plant is about the same. Therefore the price of gas will be to a great extent determined by the competitive cost of coal. But the same gas used in the cement industry would require a rate fully 30% lower in order to compete against powdered coal.

The fundamental reasons for this condition are that the flame temperature of powdered coal is much higher than that of natural gas; and as that portion of the heat that lies between the operating temperature and the maximum flame temperature is the heat which determines the efficiency of the operation, fuels with higher flame temperature and the same cost per unit of heating value, will show a lower consumption per unit of product.

It is unfortunate that nature made natural gas to have that distinct characteristic of needing heat for all dissociation of its elemental gases before combustion, thereby robbing it of its maximum flame temperature in proportion to the heat necessary for this reaction.

This problem has been the source of a great deal of investigation and research, and efforts are being made to overcome these obstacles that this one phase of natural gas offers. It is to be regretted that this work has not been started long ago in that not more active interest is shown by the natural gas companies in the development of ways and means, as well as appliances, to increase the thermal efficiency of operation through some satisfactory method of increasing the flame temperature of natural gas.

The training of men in the merchandising of natural gas is another aspect of the problem which must be given consideration. It is not sufficient to employ men who have the ability to sell your product when the application is simple or where the equipment necessary is already on the market, but men that are adequately equipped with engineering knowledge and sufficient constructive imagination to advise your customers, and if necessary, to develop new methods of application and new appliances that will give the desired result.

We employ the highest grade talent obtainable when we consider field, pipeline and compressor station, management; but we overlook the fact that the value of our product could be greatly enhanced by men who are able to demonstrate the greater usefulness of our product, and thereby give it greater value. The above statements apply to gas used for domestic as well as industrial uses.

The natural gas company, from a production standpoint, is primarily a mining industry but, unlike any other mining proposition, the prices to be obtained for its product are not regulated by supply and demand but by Public Utility Commissions that aim to secure for the people of their communities the lowest and most consistent prices for that service.

In the operation of natural gas properties, often the depletion of local fields, the extensions for new sources of supply, the installation of compressor stations and other large expenditures make it impossible for companies to operate with their present rates on a profitable basis.

The increasing of rates often entails controversies with the people which arise largely because of the lack of supervision by the company of the uses for gas, and the lack of knowledge on the part of the people just what the reasons are for the proposed change in rates.

This can be greatly eliminated if sufficient care is taken to take the people into your confidence and showing them the efforts you made to increase the usefulness of the gas that is being sold to them, and you will find that this usually paves the way for an understanding that will make it possible to secure every concession that is necessary to make your business profitable.

The Quapaw and Wichita companies some time ago realized the necessity for training men for this work and the first concrete expression of bringing this about was the organization of a corps of cadet engineers into a Combustion Department. The eight men who were taken for this work were given headquarters at Caney, Kansas, and are guided by a senior member and supervised from the New York office.

Apparatus was placed at their disposal which permitted them to determine the efficiency of any heating operation in any plant. Their first efforts were directed toward increasing the efficiency of boiler equipments with very satisfactory results.

A significant result obtained by this department shows conclusively that burner equipment in boiler installations is no real factor in determining the correct burning of gas under boilers, and while considerable value has been placed on different types of boiler burners, the result secured from a great number of installations proves that they all have about the same merit. I do not make this statement to invite a controversy, but merely to show that the boiler furnace itself is the determining factor in securing the proper results and not the burners which are simply used to convey the gas and air to the point of combustion.

By the correct study of each make of boiler, and by making changes necessary in the combustion chamber and baffle, it was possible to increase the efficiencies of these boiler plants from five to fifty percent. This service had a great deal to do with securing additional business and retaining all of the old business in the face of an increased cost of gas.

The research work carried on in this department along the line of increasing the flame temperature of natural gas has brought out some very interesting possibilities which I am not ready to discuss at present but which I am sure will be of great value to the company some day.

The work of this department is not alone to increase the efficiency of a particular operation for the manufacturer and after that to let him work out his own problems as they occur. The service of this department is always at his disposal for any problem within its scope. In this way an effort is made to maintain the continuance of standards that have been established and to set higher standards for other operations in the plants of the manufacturers.

In conclusion let me say, to sell more gas to present customers and gas to more customers at rates that are profitable, requires high grade merchandising methods, a combination of selling ability and engineering service.

DISCUSSION:

PRESIDENT CARTWRIGHT: The organization with which Mr. Loebell is associated has the reputation in the electric light industry of being one of the most progressive and energetic along the lines of securing new business. During the last few years this organization has become heavily interested in the natural gas industry and I am very glad indeed, that they come to us today with these new ideas and new thoughts for the development of the industry. I hope that this paper will receive very full consideration and thorough discussion. Probably the new business end of the natural gas industry has been as much neglected as any other portion of the business. Is Mr. Hoover in the audience? We would be glad to hear from Mr. Hoover in connection with this paper and with this subject generally.

MR. H. J. HOOVER: Mr. President and gentlemen, I think the commercial men present have all listened to Mr. Loebell's paper with very deep interest. I think it should be of value to every gas man, whether he is connected with the commercial department, or with any other feature of the natural gas industry. If we are going to get better rates; if we are going to put natural gas on a competitive basis with other fuels at living rates, we must adopt better methods of presenting its usefulness to the public and we must recommend the installation and use of better appliances. Natural gas has been used successfully in competition with other fuels; but at pitifully low rates. Used efficiently; used with efficient appliances, it can compete with any fuel at substantially higher rates. We are going to have competition and we have competitive conditions presenting themselves to us more and more all the time. We have competitive commodities constantly coming up in our efforts to secure new business and there is going to be more competition in the future. The electric light industry has made great headway. It has spent a great deal of money in research work. The natural gas industry has spent practically nothing except what has been spent by individual companies and only by very few of these.

About a year ago — or correctly speaking, eleven months ago, starting from a conference of three commercial managers at Columbus, Ohio, we formed a little organization of Commercial Managers and Industrial Engineers. We had our first meeting at Cleveland, Ohio, in July last year. Since that time we have had six other meetings. We formed the organization informally and for our own good and for the good of the companies who were represented, with the main object of trying to do some work that should have been done long ago by the Natural Gas Association of America and which we hope will form a nucleus of a department sooner or later in any new plans of reorganization of this Association. We have in our organization representatives of three companies of Pittsburgh, The Peoples Company, The Manufacturers and the Philadelphia; The East Ohio Company of Cleveland, the Columbus Company, The Logan Gas Company, The Central Indiana Company, The Louisville Company, The Ohio Fuel Supply Company and The Union Gas & Electric Company of Cincinnati. We have done in a very quiet way and in a very informal way considerable work especially in view of the fact that there are so few of our companies that are equipped with proper facilities for carrying on research work. But our work has been to exchange ideas and experiences in the application of gas and to conduct experiments along the line of efficiency; to investigate new gas burning appliances and especially to prepare a policy by which gas companies can meet the public in the spirit of fairness and in the spirit of education.

There is one feature about the work that we have undertaken that I would like, with the permission of the President, to call upon Mr. Brown for a few moments to tell you about. I think it will be of interest to us all.

Mr. Loebell, who is now a member of our organization, very kindly yesterday placed at our disposal, through invitation from the Doherty Company, their laboratory at Caney, Kansas, for all research work that we may care to engage in. It has been the hope of this little organization of Commercial Managers and Industrial Engineers that it might form a nucleus perhaps for research work looking toward higher rates which we all know we must come to and the more efficient use of gas which will help the conservation idea.

PRESIDENT CARTWRIGHT: The Chair will now call upon Mr. Burr, engineer The Logan Natural Gas & Fuel Company, to continue the discussion of this important subject.

MR. R. B. BURR: Mr. President and gentlemen; last year at Cincinnati, I had the honor of addressing the Association on "The Use of Natural Gas at Domestic Rates for Industrial Purposes." This paper and the discussion which followed, considered the use of thirty cent natural gas in the smaller appliances and furnaces.

Mr. Loebell's very able paper, as also some of our recent experiences in the use of natural gas, in some of the larger periodic forgings, bending and annealing furnaces, as also my personal observation, lead me to the belief that the possibilities of thirty cent natural gas are not appreciated, generally, by the gas industry, for the larger industrial purposes.

These experiences have suggested the thought, that ultimately it may be possible for the natural gas companies to secure all the industrial business they may eventually desire to handle at a rate not less than thirty cents. This would, of course, exclude open hearth regenerative furnaces, as also steam boiler consumption, but it is evident and obvious that there is at the present time an enormous amount of gas being sold for industrial purposes at rates ridiculously low, when the fuel cost of the product manufactured by natural gas properly applied, is compared with the fuel cost of production, under average factory operation, when coal, coke or oil is used.

It is substantially impossible to prepare, or obtain comparative unit costs of production with natural gas as compared with other fuels, which will apply universally in the different industries. This is due to the fact that hardly ever, even in the same industry, in different shops, are exactly the same methods used in the production of the product, and in the use of the fuels.

It has been our experience that in most cases it is necessary to prove to the customer in his own shop, that it is possible for him to reduce his production costs by the use of natural gas.

As an illustration of what has been accomplished in some of the larger furnaces and appliances, I have prepared a few photographs illustrating the general method of application, principles involved, and comparative operating costs, which photographs will be reproduced in the published proceedings of the Convention.

Other things being equal, the furnace or appliance with the longest flame-path will prove most efficient and on account of the flexibility and control possible of natural gas, when applied to a furnace, it is, in many cases, possible to reverse the flame-path and completely change the characteristics of the furnace, as regards distribution of the temperature, the speed of production, and efficiency, and this without changing materially the design of the furnace, or burdening the consumer with the purchase of new appliances, or building of new furnaces.

In many instances, the results just mentioned may be accomplished without making it impossible to use coal or oil in the furnace. To illustrate — we equipped, some four months ago, a battery of coal fired annealing furnaces used for annealing steel tubes. These furnaces were 30 feet, six inches long by 10 feet, six inches wide, with a maximum operating temperature of 1850 deg. Fahr. It was desired to equip these furnaces with gas in such a manner as not to interfere with the fire-boxes in any way, and it was stipulated that the equipment for gas should be so designed that kindling and coal might be in place on the grate bars at all times so that in case of a failure of the gas supply, or accident to the mains, not more than one hour's operation would be lost in the use of the furnace.

The conditions were very severe as regards the gas installation in that there was no compressed air available, steam being the only medium at hand for blowing the fires, and a further unfavorable condition was produced by the weight of the material charged in the furnace, which was sufficient in each charge to absorb the heat stored in the crown and walls of the furnace, thus chilling the furnace below the ignition point of the mixture.

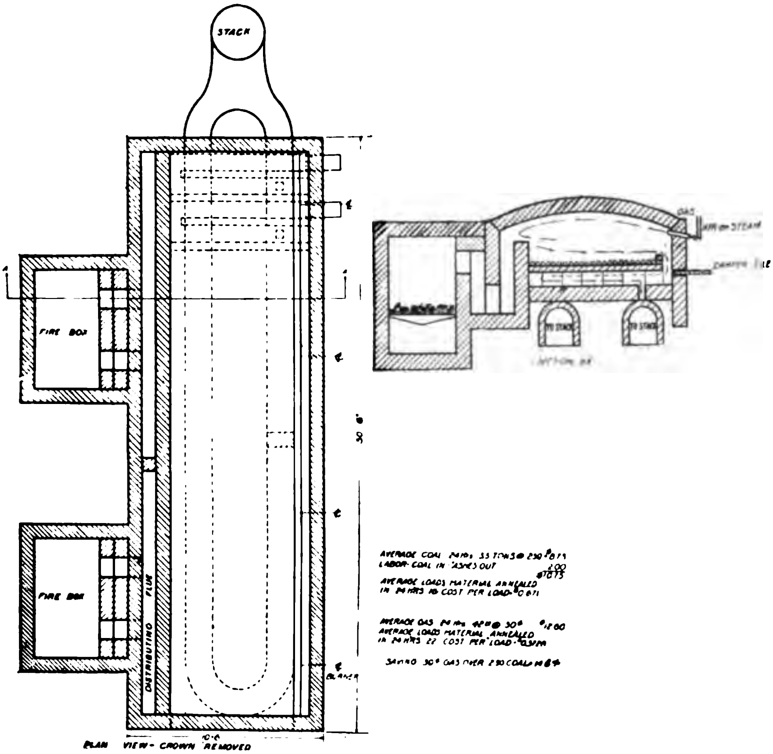
With the gas installation as finally installed, see Sketch No. 1, Photo No. 1, the furnace was charged and the tubes drawn an average of twenty-two times in twenty-four hours, as against sixteen times with coal, the charge averaging two and one-half tons with a value of approximately $300.00. It was demonstrated that the furnace had capacity to produce thirty loads of annealed, mild steel tubes in twenty-four hours, provided material was at all times available for the charge.

As will be shown in the photographs mentioned, blast burners were installed, using super-heated steam, and these burners were applied just below the skew back on the outlet side of the furnace, immediately above the outlet ports and damper tiles.

By properly adjusting the burners, it was found possible, contrary to our previous practice, to distribute the flame under the crown, burning the mixture in intimate contact with the fire-brick crown, and returning the heated product of combustion over the work, thus securing twice the length of the flame path that had been used in the original gas installation, through the side walls of the fire-boxes.

A ten days' test showed the average coal consumption for twenty-four hours to be three and one-half tons, and at $2.50 a ton, amounted to $8.75. The labor cost of coal in and ashes out on each furnace, for twenty-four hours was $2.00, making the total cost for twenty-four hours' operation of $10.75. The average number of loads of material annealed for the twenty-four hours during this test was sixteen, making a fuel cost per load with coal of $0.671.

The average gas for twenty-four hours during a test of the same duration was 42,000 feet, which at thirty cents per thousand, would amount to $12.60, the average number of loads annealed in twenty-four hours was twenty-two, making the cost per load with gas $.5728 as against $.671 with coal, showing a



SKETCH NO. 1.

DIAGRAM OF ANNEALING FURNACE, SHOWING APPLICATION OF NATURAL GAS.

Average Coal — 24 hrs. — 3.5 Tons, @ $2.50	$8 75
Labor — Coal in — Ashes out	2 00
	$10 75
Average loads material annealed in 24 hrs	16
Cost per load	$0.671
Average Gas — 24 hrs., 42 M, @ 30c	$12 60
Average loads material annealed in 24 hrs., 22 — cost per load	$0.5728
Saving 30c gas over $2.50 coal	14.6%

saving in operation of 14.6 per cent, in the use of thirty cent gas over $2.50 coal, measured gas as against weighed coal, and labor of handling it.

This saving does not include the loss due to scrap produced with the coal, as with the gas it is possible to heat evenly every portion of the furnace and to heat the open ends of the tubes next to the doors, to the same temperature as the rest of the furnace, which is substantially impossible to do with coal.

The saving in broken tubes due to improper annealing at the open ends, when using coal, was more than sufficient to warrant the use of gas even if the gas had shown an increased cost over the coal of 15 per cent.

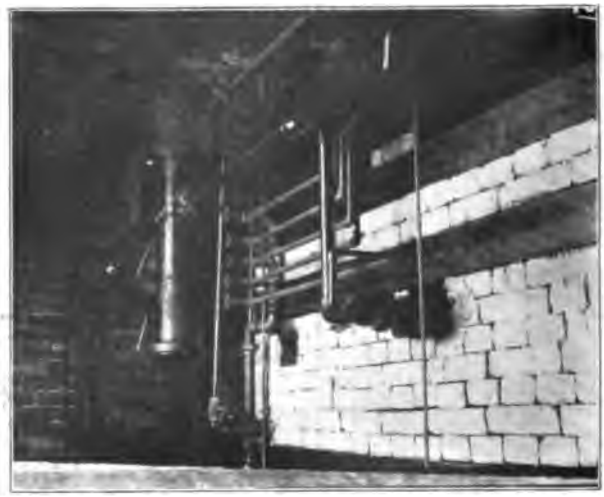


Photo No. 1.

Annealing Furnace showing Central Control of Burners and detail of construction.

The savings mentioned do not include the increased capacity of the plant, which was approximately 37 per cent, nor the reduction of the overhead on account of the reduced number of furnaces for the same output, nor the decreased repairs to fireboxes, etc. Neither does it show the savings due to uniform annealing, thus improving the quality of the product, and the absence of the expense of re-annealing charges, which frequently occurred with coal.

From previous records it was demonstrated that this method of application produced a saving of 25 per cent over the old installation of natural gas through the fire-boxes, in cubic feet consumed in twenty-four hours, and increased the output over the old gas installation some thirty odd per cent.

An installation along similar lines except that compressed air was available for blowing the fires, was made in the plate and bar furnaces of a ship-yard — see photographs Nos. 2 and 3 — these furnaces were in some instances sixty feet long in the form of a tunnel, and used for bending shapes for ship frames, others were 35 feet by 15 feet, and used for forming plates.

The average oil consumption in the department where the furnaces last mentioned were, was 813.4 gallons per day, which at 5c per gallon, would amount to $40.67. It has been demonstrated that 75,000 feet of gas per day will accomplish the same work, which at thirty cents per thousand, would make a cost of $22.50 per day, thus saving in one department, $18.17 per day.

With three cent oil, which I believe is a fair average price for normal times and conditions, the cost of the oil would be $24.40 as against $22.50 for thirty cent gas.

I am free to state that this gas is not being sold in this last operation, nor in the first one mentioned, at thirty cents per thousand, the price is more nearly 16c per thousand, and the price being paid for oil is 5½c, which illustrates the truth of my statement that in very many instances the price per thousand paid for industrial gas is ridiculously low. (Applause).

President Cartwright: I will now call upon Mr. Diescher.

Mr. A. J. Diescher: I believe it is the aim of all companies interested in the sale of natural gas to seek out and discover new channels for the use of the fuel and new methods for getting an increased price for the product as well as developing the efficiency of its consumption. Now, with this in view, we have put a clause in our contracts with reference to which I would like to speak for a moment. In all contracts which we

PHOTO NO. 2.

Bar Bending Furnace — 60 feet long.

PHOTO NO. 3.

Plate Bending Furnace — 35 x 12 feet.

have made for the past two years at our Portland plant which covers about thirty to forty million feet a day, sales of industrial gas, is a sticker attached to the contract containing a clause which states that as part consideration for the sale of gas at the price at which it is sold the consumer gives the company furnishing the same the right to have its engineers enter into the plant of the consumer and study into the plant methods and processes with a view of reducing or cutting down the supply required to accomplish maximum results and ascertain methods to reduce cost of operation or cost of gas per unit of output with, of course, the ultimate view of bringing up the price of the gas. Now that sticker is put on every contract and there was not one single instance where any consumer objected to such sticker or such a clause in his contract. Everyone welcomed it. On the face of it you would at first suppose that a lot of the operators and users of gas would be opposed to let your engineer go into their plant and study their methods of operation, even though the purpose of the inspection was to bring down the cost of the fuel. However, not in one instance out of all the contracts made have we found any objection. As I say, every one welcomed it. I mentioned that point because I think it is an experience that is important for all of us to know, that in actual operation we have been welcomed by the industrial consumers of gas and in purpose of eliminating unnecessary waste and conserving the use of gas wherever we can consistent with the results desired and sought to be obtained.

MR. J. C. MCDOWELL: I might add, Mr. President, that the purpose of this experimental station which Mr. Loebell has charge of at Caney, Kansas, is to accomplish this very thing, to improve the efficiency of the burners and lessen the cost of output and we have met with the hearty co-operation of all consumers, and we are now supplying consumers to the extent of forty million feet a day.

PRESIDENT CARTWRIGHT: Mr. Maxon, I understand, has had a great deal of experience in merchandizing gas at high prices and I am sure we would all be glad to hear from him and to have him tell us some of his experiences along the line of new business for natural gas companies and how to obtain it.

Mr. J. H. Maxon: Mr. President, I do not like to hear you say, "the merchandising of high priced gas," because when we approach the sale of gas for industrial purposes, in reality the price of the gas is often times of less importance to the consumer than is the purpose for which he is able to utilize our product with the particular object in view which he desires to attain. To evidence my experience on the subject I will state that along the lines indicated by Mr. Loebell in his paper, some fifteen months ago the little company I represent put into operation a department that we call the consumer's equipment department, established for the sole purpose of introducing natural gas for industrial purposes. The idea being that the consumers would pay a sufficient amount for the work that we did for them to cover the expense of maintaining such a department. The result has been through the operation of this little department that we have more than doubled the sale of industrial gas entirely by means of going into the factory and making ourselves a part of the operating force of that factory and studying the needs of the consumer and providing him with equipment that will meet his needs. The fact has been that we have not been able to secure from the consumers compensation sufficient to make the department pay expenses and we really have lost, or failed to receive pay for work we have done to the extent of about one thousand dollars per month. However, the business acquired has more than justified us in the establishment of this department and we will continue to operate this department even though we were sure that for all time to come we would lose a thousand dollars per month or more.

I feel there is a great deal that can be done along this line. The replacement of appliances and the utilization of natural gas as compared with other fuels is the matter that receives the most study and there are a great many fields not yet touched. I will mention at this time that there is an opportunity to produce some revolutionary results in the application of gas for industrial purposes by the mechanical premixing of air and gas and also the preheating of such mixture. Our experiments are not far enough along for me to give this meeting any further information, except to advance the thought that if natural gas and air be intimately mixed, mechanically combined, reaching the point of combustion, wonderful results may be obtained, and I may say that our experiments have extended far enough that even now we have obtained results by such methods which are absolutely astounding.

President Cartwright: Mr. Krick, have you anything to say? You have had wide experience in the commercial end of the business. Let us see what your experiences have been.

Mr. Kay C. Krick: Mr. President, I hardly think I can add very much to what has been said except to give the work my unqualified approval and to say that the experiences mentioned have tallied exactly with the experience of our company. Mr. Burr, our engineer, has given you an inkling of the work we have done along this line and also covered the subject quite completely in a paper before the Cincinnati convention last year. We have been engaged in this sort of work for about two years. We have found it more than successful. With reference to the installation of natural gas in a large part of these industrial enterprises and plants — even ovens and furnaces of such size as Mr. Burr has described, we approached the work with much confidence and have been able to carry it through with uniform success. I am thoroughly convinced that as the time approaches when gas companies will not have that volume of gas which will permit the sale to industries generally and indiscriminately, a solution of the matter of the sale of all the gas we desire to sell for industrial purposes can be found at approximately thirty cents.

Mr. J. C. McDowell: As a matter merely of information, Mr. President, I may say that I am connected with companies that at the present time are furnishing large quantities of natural gas for industrial purposes and I have in mind one industrial concern to which we are now furnishing between five and ten million feet daily at a price between twenty-five and thirty cents.

Mr. L. L. Weisenberger: To further illustrate the point brought out by Mr. Loebell with reference to selling the consumer more gas, I had occasion the other day to look up the gas bills of six of our consumers, as we had a prospect for furnishing gas for a heating system, and I looked up these bills to show this man what his neighbors were accomplishing from six specific installations of this kind. I found the consumer before making the installation was only paying sixteen dollars per year, but after the installation he was paying us one hundred and twenty dollars per year. Of course, our meter investment and our overhead remained the same. I am not saying whether that is a good thing for a gas company or not, but it looks to me like we stand a better chance of making money on a hundred and twenty dollar per year than on the former charge of sixteen dollars.

Mr. W. Re. Brown: Mr. President, Mr. Hoover in speaking on this subject referred to some of my experiences and to some of the work we have been doing along this line and had reference no doubt to a hand book which we have been preparing and which treats directly on the subject now under discussion. Before referring in detail to the matter of the hand book, I would just like to call particular attention to a paragraph in Mr. Loebell's paper for the purpose of emphasizing it. It reads as follows: "The increasing of rates often entails controversies with the people which arise largely because of lack of supervision by the company for the uses for gas, and the lack of knowledge on the part of the people just what the reasons are for the proposed change in rates."

Now that is all I have got to say about rates. In our department we do not talk rates. In fact, we never refer on our own initiative to such earthly things as rates. We try to get the people to forget that there is such a thing as a rate on natural gas and endeavor to bring to their attention the fact that there is a service there which we are seeking to render them and the price of that service is commensurate with the service we seek to render. I am not suggesting anything by way of advice to the executives of the various companies, but I do desire most emphatically to call to the attention of the members of this association the fact that there is such a thing as service and there is such a thing as a natural gas company selling service as distinguished from the old method of merely selling gas. We were discussing this subject the other day and one of our men suggested during the discussion, "I think the thing we better do is to stop selling natural gas." Of course, that caused a pause for a moment for it looked like rather a revolutionary and novel procedure. This gentleman was from Cleveland, Ohio. Then he continued, "What we are doing in Cleveland is selling gas service." I think if you will follow up that line of thought, the more you think about it, the more you will realize that that should be the slogan which the heads of all of the commercial and new business departments should adopt. "Selling service." You will find it will be of great aid to you in producing and holding new business. Take the Ohio Fuel Supply Company. We have been publishing a gas magazine, which a number of you have probably seen here at the meeting. We endeavor to create the impression with the consumer that we are trying to help him solve his problems from his standpoint as to the matter of the dollars and cents of the service we are seeking to sell him and we try to leave him with the belief that we are working in his interests as well as for the company we happen to represent; that it is a matter of mutual undertaking on our part and on his part to bring about economies in service and use which will inure to his benefit in the saving of gas wherever it can be saved consistent with maximum results or with results desired to be obtained. This course on our part has helped us a great deal in the sale of appliances to consumers using our product. The fact is, by this mode of procedure, we have created a friendly feeling between the producer and consumer, which is of great value in prosecuting the work of the new business departments. We seek to give to them the benefits of our research work and suggest to them the most economical and efficient appliances for their use. We find when we approach the consumer in a spirit of fairness that they believe in our motives and our methods and they accept it in preference to any other kind of an argument that may come up. In this way we have created in the few years we have been prosecuting this plan a feeling among our customers that we are working in their interests. That in a word is the work of this group of Commercial Managers and Industrial Engineers that Mr. Hoover has told you about.

Now, Mr. Hoover asked me to refer to the hand book that we have been preparing. So I will come to that at once. We are preparing among ourselves and have been working towards it for some time, a handbook, the idea of which is to carry out the character of campaign I have just outlined. We have found it quite a task to take into consideration every feature of the commercial end of the business. It will not deal so much with the old questions of how to turn on the gas in the stove or how to turn the gas off again as to bring before the consumer the importance of efficient service sought to be rendered by the company to the consumer. We endeavor to show them the character of the whole organization behind the selling end and behind the service we agree to sell them. We bring to their attention the scope and extent of the organization behind the service sought to be sold from the point where the gas is obtained in the bowels of the earth on down to the burner, and we try to make the consumer appreciate the fact that the men in the field are but a part of the producing force, and the distributing force and the commercial force engaged all the time in bringing this commodity to his door; that a great body of men are working away in this field engaged in the duty of bringing to the consumer this service and placing it at his disposal every day, every week and every month of the year, regardless of outside conditions. As I say, we are preparing a booklet along this line, demonstrating to the consumer the extent, scope and character of the organization back of the service we seek to sell to each individual consumer. Our first chapter is headed, "We seek to serve." Then we go on and endeavor to bring out in the second chapter some of the things necessary to offset some of the fallacies and wrong ideas that people have of gas companies in general, such as air in the gas and, "Why are my gas bills higher than my neighbor's who has the same sized house as I have." We endeavor to bring that out and yet not encroach on the other departments of the company. It is quite a task to prepare and promulgate all that may be said on such a subject, but we have it now about prepared and as we have it prepared, we are going to submit it to experts on higher salesmanship, men such as Mr. Loebell speaks of; men who know from experience how to handle the psychology of the selling end only as such experienced experts know it and understand it, and after we have submitted it to all of the acid tests at our command, then we are going to produce it and we believe it will do a lot of good in the natural gas industry and will be the means of inaugurating a campaign for new business for the natural gas companies and how to obtain it that will work to the benefit of the consumer and the gas company.

MR. JOHN M. GARARD: Mr. President, this is a very interesting discussion, but the time for our usual recess is growing near and therefore, I move you that a vote of thanks be tendered to Mr. Loebell for the very excellent paper on this all important subject and also to the gentlemen who have so ably discussed it.

The above motion having been duly seconded was then carried.

PRESIDENT CARTWRIGHT: We will now recess, but before going I want to again urge that we have a full attendance this afternoon and I ask that those here this morning not only come back for the afternoon session, but I urge all the representatives of the different companies to insist upon their men who are in attendance being present. This is where their work lies rather than in the exhibit hall and it is too cold for the baseball game anyway. We will now recess until 1:30 P. M.

And thereupon the Association then recessed until 1:30 P. M. of same day.

SECOND DAY — AFTERNOON SESSION.

WEDNESDAY, MAY 17, 1916.

PRESIDENT CARTWRIGHT: The convention will please come to order. The next order of business upon the regular program is the report of the Committee on Uniform Accounting by Mr. Reeser.

Mr. H. C. Reeser then submitted the following:

REPORT OF THE COMMITTEE ON UNIFORM ACCOUNTING.

Mr. President and Members of the Natural Gas Association of America:

I think it might be well for me to remind the members of the Association first as to what the Committee on Uniform Accounting has tried to accomplish. We all know that hardly any two gas companies keep their books exactly alike and hardly any two of the accountants of the larger companies even agree on how certain charges should be made. That is whether they should be charged to expense or investment, and the purpose and object of the work to be performed by this committee is to endeavor to formulate, recommend and establish a uniform system of accounting so that all gas companies will be keeping their books exactly alike and also have the public utilities commissions of the various states in which we are doing business adopt the same system.

Now, I had a peculiar experience sometime ago — a few years ago it was. I had occasion to investigate a small gas company which we were investigating for the purpose of making a purchase, and in going over their accounts I found that they had peculiar ideas about keeping books. For instance, they charged gas used under the boilers to investment and the manager and the bookkeeper were sincere in their belief that that was the proper place to charge it. They did not seem to know anything about charging to expense, but thought that everything ought to go to investment. That only illustrates in a way the importance of this subject to all gas companies.

For the last few years we have been working on this system trying to get all companies to adopt it and we finally agreed, as you will probably remember at the St. Louis meeting two years ago, on a system that all the larger companies were willing to adopt and the meeting approved and adopted it. Since then we have been endeavoring to have the public utilities commissions of the various states adopt the same system. It has been rather a hard task to get them all to agree, but we think we have done so at last. We had a meeting the second day of this month at which time the public utilities commissions of Ohio, West Virginia and Pennsylvania were represented and the Ohio representatives agreed to adopt our report. Pennsylvania and West Virginia, — while they agreed in the main on our system, — thought they would like to have a little more time to think it over, especially in view of the fact that it can not go into effect until the first of next year, and they wanted some more time to consider it. So we agreed on a tentative date — that is August 1st — to meet and finally adopt the system for all three states. When that is done we will only have to make up one set of reports for the Commission. That is, at present Ohio requires one set of reports, West Virginia another and Pennsylvania still another one, but when this new system goes into effect all three states will have exactly the same kind of a report to be submitted and it will simply be copying our annual statement, so that it will not require any extra work or labor to make up the statements. We hope also to have the tax commissions of these various states agree to the same system which will greatly simplify our accounting.

Now, in as much as this system can not go into effect until the first of next January, and it will undoubtedly be adopted by the public utilities commissions of those states before that time, I think it might be a good idea to authorize the Secretary of the Association to have the report printed in booklet form when finally adopted and distributed among the members, so that they can all familiarize themselves with it and get ready to start in on the new system by the first of January and I, therefore, recommend that the Secretary of the Association be authorized so to do. That is about all the report at present, Mr. President.

President Cartwright: Any remarks on the report of this committee? As I understand it, Mr. Reeser, you proposed to have the report of the committee printed and distributed after the same has been adopted by the three states?

Mr. H. C. Reeser: It has already been adopted by the Association and agreed to by the eleven accountants comprising the committee.

President Cartwright: If there is no objection, the Chair will ask that this report be received and placed on file and the committee continued. I think the committee has yet considerable work to do and I would like very much to have the approval of those present to the continuation of the committee until its work has been completed.

MR. J. C. McDOWELL: Mr. President, I move that the report be received and the committee continued and their recommendation complied with.

PRESIDENT CARTWRIGHT: And that includes, of course, the recommendation in the report of the committee to authorize the secretary to have the report printed in booklet form and distributed among the members.

MR. J. C. McDOWELL: Certainly, the motion carries with it the acceptance of the report and the adoption of the recommendation of the committee.

The above motion having been duly seconded was then unanimously adopted.

PRESIDENT CARTWRIGHT: We will now have the report of the Committee on Rates of which Judge Douglass is chairman.

REPORT OF COMMITTEE ON RATES.

JUDGE S. M. DOUGLASS: Mr. President, the report of the committee will be presented by Mr. Alfred Hurlburt who is associated with Mr. McDonald and myself on the committee. Just one observation I desire to make prior to the reception of this report. Pursuant to a resolution, the duty was enjoined upon the President of the Association to appoint this committee. The personnel of this committee consisted of Mr. Donald McDonald, Mr. Alfred Hurlburt and myself. The business demands upon Mr. Donald McDonald's time and other sufficient reasons made it impossible for him to participate with the committee and we, therefore, with much regret, lost any suggsetions or recommendations coming from him. However, this convention will remember the very excellent paper that he read and the very splendid reception which the paper received at the hands of the convention at the meeting last year at Cincinnati. Geographically, "my fellow sufferer" on this committee, Mr. Hurlburt, and myself are widely separated. We, however, did feel that we owed a duty to this convention, however illy we might be able to perform it, to get busy and get together and have a report of some character. That is all I desire to say in that connection. The convention knows just exactly why the report is not signed by Mr. McDonald and why we do not have the benefit of his valuable experience. With the permission of the Chair, Mr. Hurlburt will now present the report of the committee.

President Cartwright: I will now call upon Mr. Hurlburt to present the report of the Committee:

Mr. Alfred Hurlburt then presented the following:

Just and Equitable Natural Gas Rates.

At our last meeting in Cincinnati, the incoming president of this Association was requested to appoint a committee of three to submit to this convention, a report covering the fundamental principles involved in fixing fair and equitable rates to be charged for natural gas. This obligation has been discharged by your Honorable President, and such committee was appointed.

This committee was given authority "carte blanche" to seek and obtain information from any and all sources where exact and accurate data and information could be obtained, and now beg leave to submit its report.

This report will be in the nature of a diagnosis, a recommendation for treatment, and may savor somewhat of a post mortem. However, it will not be technical, and will have little to commend it when measured by the engineer's point of view, but rather consideration will be given from practical, prudential and political points of view.

The purpose of this committee will be accomplished if from the field of practical experience and advanced thought, we shall be able to glean and suggest the fundamentals of a scheme or plan for rate making that will be just and equitable, and that shall meet with favor from a prudential and political expediency point of view, and at the same time be consistent with well established engineering rules.

The major purpose, however, is to interest this convention and provoke a discusion that will result in a thoughtful consideration that will eventually lead to a definite solution of the *problem or problems* confronting and vitally concerning natural gas interests and industry of this country.

We desire, first, to impress upon you that all recommendations here sought to be made, do not contemplate a general rise or advance in the price of gas at all, but it is simply a recommendation of readjustment to cover actual consumer costs; or, in other words, to cover an inevitable loss incurred by every gas company under the straight line system of rates.

We are not committed to any special scheme or amount of any rate schedule, but we are committed to a principle that will insure fair and equitable rates. We are against any accepted scheme of rates which must result in actual and admitted loss by any large class or number of consumers.

In any discussion of rates it is necessary, first, to make a brief survey of the great natural gas industry so that we may see the field, its varying conditions, and the subject matter with which we are called upon to deal, and to which our recommendations must adapt themselves, if they can be of any universal value. Theoretical or chimerical schemes of rates, however, attractive, would never commend themselves to the leaders of the natural gas industry who have learned to test everything by practical results. We therefore must,

First: Keep in view the different circumstances and conditions that surround the different gas companies widely scattered over a vast area, as they are.

Second: We must have regard for many companies now distributing under accepted rate ordinances that can not be departed from until the expiration of the term.

Third: We must likewise keep in mind also, the many companies which perform the three functions, to-wit: Production, Transportation and Distribution.

Fourth: We must have like regard for cities and villages in which there is sharp competition.

Fifth: We must keep in mind that many selling companies are buying gas largely, have definite time contracts made, and must find a market.

Sixth: That many companies are producing, transporting and selling at wholesale, at a definite fixed price, for a definite term, and are not essentially concerned with the price of distribution when once fixed at the gates of a given city.

Seventh: We must likewise remember that many instances wherein two companies are united in interest under a percentage contract; as for instance, the old 70-30% "tying-in" contracts (which should never have been made), and wherein the companies' ultimate interests are identical.

Eighth: It is well known that many companies are carrying large leasehold interests in many fields, amounting to hundreds of thousands of acres; that in competition with other companies they are forced to drill to protect their properties beyond their present demands, and are, perforce, compelled to find a market whether the price be satisfactory or otherwise.

We must likewise consider that gas companies have not the right to initiate their own rates; they are either made and fixed by local municipal councils, or by state commissions; that any scheme of rates, no matter how just, that does not upon its face appear attractive, or is not susceptible of clear explanation and demonstration, has scant chance to be universally accepted, or meet with favor and the approval of rate making authorities.

These are some of the major things to be considered, because they lie at the foundation of any scheme of rates wherein it is sought to give them universal application.

The goal to be reached in every enterprise is a just and adequate return. This alone guarantees continued existence and good service. Men, either singly or collectively, will not devote their money, brains and energy in any business that does not, when properly and wisely managed, give reasonable promise of profit. The public which the utility serves owes this duty to enterprise and development if they would conserve their *own* best interests. It is only when a public business is unwisely managed so that on that account it entails an inevitable loss, that then the public or those served must not be penalized in order to bridge inefficiency wherever found.

The object of a service charge to cover consumer's cost is not to make money for the gas company off of the poorer class of its consumers or any class of consumers. Its purpose alone is to free the company of a burden which the present straight line rate imposes upon it, and which it must of necessity transfer to its profitable consumers.

It is fundamental and a principle always to be regarded in relation to every public service, that it should not be allowed to do *any business at a loss.* No man, no matter what his status, in the role of a consumer has a right to make any such demand, much less to have it complied with; and no council, court or commission acts wisely toward the *public* when they permit a consumer either to exact from a public utility, service below cost, or aid, or enforce such demand, because the inevitable result is to invite certain and continued *poor service,* and put a premium on ill-concealed discrimination.

It is only within the last few years that there has been any marked departure from the old plan of a straight line rate or price per thousand cubic feet, for gas delivered with occasional instances of establishing a minimum charge. The equitable features of this basis of charge have been recognized by suggestions of a "consumers charge". But these suggestions did not meet with popular favor, and not until within very recent times has it been sought to cover this feature of a consumer's charge to meet consumers' costs, by a graduated scale of prices whereby the charge for the first few thousand cubic feet of gas would include this cost.

Actual experience has demonstrated that the consumers' costs range from 50 cents to $1.00 per month and there has been much discussion and some crystallization of sentiment among operators that a proper rate schedule should distribute the consumer's costs equitably between all classes of consumers, for the very patent and just reason that every consumer should pay *at least* the cost of service, and this view has been fortified by the fact that this method of charge has been adopted in the electric light service, has proved satisfactory to the consumer; that it is economically right, and places the burden which otherwise would rest upon the few, when, concededly, it should be borne by all.

The argument for this is, that it transforms the losing consumer into a profitable one. The schedule of rates here suggested, to-wit: a higher price for the first few thousand cubic feet, and a minimum charge, heretofore discussed by this Association, does away with the abstruse and technical terms of "demand charge," "consumer charges," and "readiness to serve charge;" but when applied its effect would practically insure a return covering consumers' cost when patrons use less than one thousand cubic feet per month. It preserves a schedule upon a plain rate basis, easily understood, and does not interfere or deter any other class of consumers.

It has been repeatedly stated in papers read before this convention, and in general discussion, that an analysis by all the companies of their *gas sales* and careful *classification* of *consumers,* will reveal the fact that more than 50% of their consumers are carried at a loss, and that the burden of making up the deficiency rests entirely upon the small percentage or body of its large consumers. It is very apparent that such a policy is economically wrong, and that a gas rate schedule designed to eliminate any and every consumer carried at a loss, can be nothing other than equitable and just.

Notwithstanding the fact that all this may be true, very little advance, as far as natural gas rates are concerned, has been made wherein the features here suggested have been urged and pressed before rate making bodies while these features all have been given recognition in electric, water, and manufactured gas rates.

We are all aware that the facts concerning the development and marketing of natural gas in its early history, naturally produced the straight line rate. The notion then was, to find a market for the gas, and fix a price that would return as quickly as possible the investment that occurred in the production, transportation and distribution of the gas, and this led to the establishment almost uniformly, of very low rates, and with little regard to any careful adjustment of the same. This arose because the producers and sellers of natural gas, as a rule were driven to this procedure by the fact that no one had entire control of a given gas field, and there has almost always been a "Marathon" rush to see who should get the gas out first, sell it the quickest, and secure the most money before the field was exhausted. Has not the time now arrived when a more careful procedure may well be adopted, in view of the fact that many of the fields are more firmly controlled, and that the market for the gas produced generally exists quite distant from the source of production? It may be well for gas operators now to know for what purposes, and in what markets it has been found feasible and practical to sell natural gas. Discussion might not inappropriately be indulged in reference to the sale of gas for commercial and industrial purposes, but the limits of this report should confine us more directly to what is commonly known as *domestic* sale, which covers the large body of consumers, probably over 75% of which are residences, and the remainder being places of business of various kinds.

We all understand, in fact it is everywhere conceded, that all rate making must be based on a reasonable return on the value of the property, (tangible and intangible) used and useful in the service of the public, and this return should be proportioned over the consumers in such a ratable way as to make each consumer stand the expense he imposes. A flat rate or straight line rate can never do this, unless every consumer uses gas in the same way and in the same amount.

PUBLICITY.

We think that experience demonstrates that the public when properly and fully informed, is inclined to be fair; but they must have the proper information. Neither a large nor an influential body of consumers are dishonest, nor do they desire a good service at less than cost; but we, perhaps, have started on a wrong premise, and have fixed a bad precedent, and it is now up to us by proper *publicity,* to make a presentation of our case, backed by facts and figures drawn from past experience, that will be unmistakable and unanswerable.

We must prove that the other or straight line rate is wrong, and that this proposed plan is right. A decided majority of the people desire to be just and honest, but we must be fair with *them;* we must be open and frank. There is nothing to conceal, and special effort ought to be made to convince the public and rate-making authorities that they have the whole story without evasion, addition or subtraction. If our case be stated honestly and completely, it is its own vindication. We are entitled, at least, to the same kind of consideration that electricity and artificial gas are holding in the public mind.

But the great difficulty is not with the public. It is with those charged with the duty of initiating and making rates. It is far from sufficient to prove the injustice of low prices when it affects small consumers. The association of ideas between the small consumer and the poor man seems to be indelibly fixed, but your analysis of accounts will, we believe, in practically all places, prove this to be fallacious, and the inclination of the public official, to permit even injustice in favor of the poor man is almost universal, and it appeals to the better instincts of humanity. We may prove that the small consumer is getting service at lower cost and much cheaper than he ought to get it, because he is a losing venture; but to do so, is not only to incline the average public official to act for the continuation of such a system, but he welcomes it as his life preserver at the next election, and uses it as a buttress to prevent his official position from slipping from its pedestal, when he is that pedestal.

Therefore, any proposals that are to be made to the public in reference to an adjustment of rates, it seems highly desirable and important that an effort be made so that the public officials may have some good grounds to stand upon that tally with *political expediency,* and that good, and only ground is, that his constituents, who are our consumers, are favorable to such a just plan.

We therefore oftimes begin at the wrong end. Wise and judicious advertising, ploughing and fertilizing the ground in the field of our consumers; and thus preparing the public mind for any contemplated adjustment, is the only firm and solid base upon which we may hope to have any such policy or plan meet with favor, or be adopted by rate-making authorities.

The city of Cincinnati is a notable example of giving to the public the reasons why this scheme or plan of rates is not only just, but is even in the interest of the consumers.

Let the good work go forward!

It tallies with the experience of all of us, that it is very difficult to get away from established precedent, and any argument based upon inequities and inequalities is far from convincing if the result, in any degree, bears more heavily upon any given class of persons. Therefore, in making any proposals for changes in rates, no matter how just, the *public mind* must first be prepared to accept it. In other words, the *public mind* must be satisfied with the new proposition proposed. Public officials who regulate and fix prices must be considered because we have it on high authority that "Paul may plant, and Appaulus may water," but the Divine Hand can alone give the increase. So likewise, gas companies may create and install their plant and abounding gas wells may flow, but we must remember that municipal councils and state commissions alone can give the increase.

Therefore, if this proposed change that converts the unprofitable consumer, to a profitable one, that gives to him his service at cost, that does not penalize the large profitable consumer to make up the losses of the unprofitable one, all of which facts are fortified by experience, by decisions, by equity and every principle of economics, is made; nevertheless, if these adjustments and changes are not easily and conclusively demonstrable and made unanswerable, they fall far short of a *possible chance* to be generally received and acted upon by rate making authorities; and in the light of all these accepted and proven facts, we might well doubt that because a straight base rate is more attractive, although it bears heavily upon the large user, and countenances a policy of downright discrimination, whether we must not "grin and bear it," and thus ignore the more equitable rate; but, of course, the vice lies deeper than the fact that one-third are served at a loss; that about one-third of the residue break even with actual cost, and while we are entitled, as a matter of right, to all the profits of the last one-third, designated large users or consumers, we are compelled to hand over a part of these profits to those whom we serve at a loss in order to recoup our losses there; and in this view of it, the inequality, the inequity and injustice of the whole scheme is very essentially emphasized.

To sum it all up, it has been demonstrated beyond dispute or cavil, that strict adherence to the old straight line, or base rate, creates a large class of unprofitable consumers, which should all be profitable ones; that the means is in our hands, without discrimination, or the slightest injustice, to convert this large aggregate percentage of loss into a small but certain profit. Can we do it? Shall we do it? If not, why not?

Respectfully submitted,

S. M. Douglass,
Alfred Hurlburt,
Committee.

As pertinent hereto, we herewith copy verbatim, under the caption, Rate Schedule, from a communication from the Union Gas and Electric Company, to the city council of Cincinnati, Ohio:

RATE SCHEDULE.

In the fixing of a rate schedule it should be borne in mind that a large percentage of the operating costs of a gas distributing company are directly proportionate to the number of consumers served rather than to the amount of gas consumed. An analysis of expenses for the year 1915, shows that the expense of reading meters, billing and collecting, together absorb the entire revenue received from customers whose average bill is 30 cents per month; but such expense represents only a small percentage of the revenue from customers whose average bill is $10.00 per month, and a still smaller percentage of bills of $25.00 and upwards per month. In any increase of gas rates, the proportion of increase should be *several times larger* in the case of the *small consumer, who is now unprofitable,* than in the case of the large consumer, whose business would now yield a profit if not offset by the losses from the smaller consumers. In an *equitable rate schedule,* therefore, the increase should be relatively small in the case of a profitable consumer, and correspondingly larger in the case of the small and unprofitable consumer. This has been provided for in the following schedule of rates which our Company is willing to accept, effective May 26th, 1916, upon the expiration of the last temporary rate ordinance:

For the first thousand cubic feet or fraction thereof, monthly ....60c per M. cu. ft.

For the next two thousand cubic feet, monthly	55c per M. cu. ft.
For the fourth and fifth thousand cubic feet, monthly	45c per M. cu. ft.
All excess over 5,000 cubic feet, monthly	35c per M. cu. ft.
Minimum monthly charge	60c

The above rates to be increased by 5 cents per M. cu. ft. in case the bill is not paid within 5 days.

Based on the consumption of gas during the year 1915, the above rate schedule would produce an increase in revenue to our Company of approximately $1,250,000.

This schedule represents an earning of 7% upon the minimum fair value of the property. The Company feels that a much larger increase, while justifiable as a reasonable rate or return, might so reduce consumption as to offset some of the advantage. On this account a moderate increase is proposed, in the hope that the net result will prove beneficial to the company without undue hardship to any consumer.

I herewith append to this report, and make it a valuable and instructive part thereof, — "a hypothetical case," wherein the contributor out of the fullness of his wide experience, in admirable concrete form, puts the whole argument. After discussing the uses of gas in the home, comparative heat units, efficiency and prices between natural and artificial gas, he says:

HYPOTHETICAL CASE.

Let us assume a case of a community of fifty thousand inhabitants where there is a supply of gas available at the city limits (Let this case be either artificial or natural gas) and let us assume that within such a community, after a complete distribution system has been laid down and the various premises connected with the service pipes and equipment that there might be found to exist ten thousand consumers who would use the gas supply for the various purposes; it is safe to assume that a least seven thousand, five hundred of these consumers would be residences (residence premises).

What are the conditions that must prevail, in order that the gas utility may operate in such a community and sustain itself?

1st. It is assumed that a properly constructed distribution system exists; that the supply of gas is dependable and that proper provisions for the delivery of gas to the consumers have been made and proper equipment provided for the utilization of gas in the premises. 2nd. It is necessary for the utility to maintain an office or place of business and a force of employees, adequate to handle the various kinds of work that occur incidental to the delivery of gas. The office must have its accountants, its meter readers, etc.; the distribution department must have its foremen and superintendents, fitters and laborers, and in fact there must be maintained a corps of employees who are trained and prepared to take care of all of the necessary things and work that are incidental to the distribution of gas.

The meters must be read, the accounts kept, bills rendered and collected, and the various complaints of the consumers attended to, and constant care must be exercised to maintain adequate deliveries of gas as to pressure, etc. Taxes and other charges against the property involved in the distribution system and against equipment maintained and necessary to the work of the utility must be paid.

Summing it all up, it will be found, that in any gas utility there exists *necessary expenditures of large amounts that have in no way any connection with the costs or value of the gas that is delivered.* Even though the gas supply at the city limits of this community were furnished without charge, the items of expenditure that have been mentioned and many others would still occur, as they are all expenditures incident to the distribution and delivery of gas to the consumer, and the cost per consumer as regards these charges are practically the same for each and every consumer, alike, and in consideration of what must be charged in order that a gas utility may continue to exist, it is necessary to take these expenditures into consideration; and to determine what the cost per consumer may be, — divide the number of consumers served into the annual expenditures other than for those expenditures which occur relative to the procurement of the supply of gas, when we will obtain what may be known as the "consumer cost," viz: that amount per annum which is necessarily expended to keep the utility in operation, other than that amount which is expended for the supply of the gas, which the utility delivers to the consumer.

Numerous investigations and careful calculations have shown that the *annual consumer* cost is rarely less than *$6.00 per consumer,* and is frequently found to be in excess of this amount per consumer. It is evident if this cost per consumer does not include any charge for the gas that is furnished the consumer, that unless an amount is collected each year from each customer equivalent to the consumer cost, and in addition to this collection an amount is collected from each consumer equal to the value or cost of the gas that is delivered to him, then such consumer would be served by the utility at a loss.

In this example, then, where there are ten thousand consumers and assuming that the consumer cost as above mentioned is within reason it is seen that the gas utility must collect from these ten thousand consumers not less than sixty thousand dollars per annum, and possibly as much as one hundred and twenty thousand dollars per annum to cover the necessary expenditures other than those expenditures it makes either for production, manufacture or purchase of the gas which it supplies.

It then becomes necessary to make a charge which may be known as a commodity charge which will cover the value or the cost of the quantity of gas that is delivered to the consumers, and also to embrace within this charge a sufficient amount above its actual cost or value, to provide earnings from which fixed charges and depreciations may be provided for or taken care of, and unless these things are provided for, it is a certainty that the utility cannot sustain its operation.

Now what do we find in actual practice in the Natural gas industry?

Is it not that rate charges for natural gas service have been fixed in cases, such as the above, by assuming that the ten thousand consumers will use approximately so much gas per annum at a certain price? And this, without regard to the variation in the quantity used by the different consumers, but only based upon a calculation as to the average delivery of gas per consumer? It has been found by practice that in a community where ten thousand consumers were served with natural gas with the average price of natural gas prevailing, that it was safe to calculate that the domestic consumers would use an average of one hundred thousand cubic feet of gas per annum, and therefore, it can be calculated that there is a possible sale of one billion cu. ft. per annum of natural gas to ten thousand gas consumers, and assuming that there has been no industrial gas sold, either on account of the community not having industries where such gas might be used, or on account of the prices not being competitive with other fuels, so that it could be used in the industries, what might the result of such an operation be?

Let us assume that the gas might cost twenty cents per thousand cubic feet at the city limits,— For that value then, one billion cu. ft. of gas would cost the utility two hundred thousand dollars: let us further assume that the cost of operating the utility other than the cost of gas might be $7.50 per annum per consumer; then the costs other than the costs of gas would be seventy-five thousand dollars per annum; let us further assume that the selling price of the gas was thirty cents, straight, then the annual revenue of the utility would be three hundred thousand dollars: Thus making the entire cost of operating the utility two hundred and seventy-five thousand dollars; and the gross revenue obtained from the operation being three hundred thousand dollars, the difference being twenty-five thousand dollars, which would be applicable to fixed charges and depreciation, etc. It is apparent that no gas utility could continue to exist under such conditions, and unless there be an ability to secure business other than domestic sales, or unless it would be possible to increase the amount used per consumer (domestic) beyond the one hundred thousand cubic feet per annum, then this operation would not be attractive to capital.

These are actual conditions which prevail in general throughout the country where natural gas is served as to the sale of domestic gas. And how is it, then, that the utilities are able to continue in operation?

There must be only one answer, and that is, that the losses incurred by serving unprofitable consumers are more than offset by earnings from profitable consumers.

Why is it assumed that in a community where natural gas is being marketed for domestic purposes that one hundred thousand cu. ft. per annum may be sold, on an average, to each consumer? It is because to that extent the accounts of the gas companies have been analyzed, and it has not been difficult for the gas companies to total up their gas sales at the end of the year, divide the sales by the number of consumers served and in many cases about one hundred thousand cubic feet per annum per consumer has been the result, but when any attempt has been made to further analyze the sales of gas astounding figures have been produced, which have shown that a great many consumers use a very small quantity of gas, and that the average mentioned is only obtained by reason of the smaller number of consumers who use very much in excess of the one hundred thousand cubic feet, per annum.

Wherever a careful calculation has been made of cost of serving individual consumers, it has been found that in most gas utilities over one-half of the number of consumers served are served at an actual loss to the utility, and this for the reason that the consumption of gas is small and the charge has not been sufficient to cover the consumer costs and the costs of the commodity delivered, and wherever such an analysis has been made, it has been clearly shown that the profits from the large consumers or users offset the losses of the smaller users, and only where such is the case can the utility show a net earning.

After considerable study of the matter of charge for gas, it is my conclusion that the most equitable and fair method that could be devised would be that each and every consumer is charged each month with an amount that would practically equal the consumer cost, and if this would be done, then it would be practical to fix a straight line rate for the gas delivered, provided that we did not take into consideration the variation in demand as between different consumers, and until very much more progress has been made in the establishment of more equitable rates in the natural gas industry, I think that this *de-*

mand cost or charge be not considered, as it will only tend to confuse the issue.

In no case to my knowledge has any service charge been attempted for such consumers aside of the charge for gas, and I doubt if men of the gas industry could be induced to undertake to introduce or try to establish such a charge, even though they be convinced of the equity and fairness of such a charge. Nevertheless, it is possibly worth while to consider at this time whether or not it is not the better part of wisdom to strongly advocate such a method of charge.

There is a way, whereby this same thing may be to a certain extent accomplished, without making a separate charge for consumer cost or service charge, and that is to make the charge for the first one thousand cubic feet of gas delivered high enough so that it will not only cover payment for the value of the gas furnished but also the payment for the consumer cost. To accomplish this, it is necessary to fix the price of the *first one thousand cu. ft. of gas delivered* at a figure of say, from Eighty Cents to One Dollar, and it is also necessary to provide a minimum charge, so that in the event the consumer uses but a very few hundred feet of gas, or perhaps none, his consumer cost is still covered within the minimum.

After the first thousand or first few thousand feet of gas have been charged for at a rate much higher than that which usually prevails, then the charge for the succeeding amounts of gas delivered should be fixed at a price which will make the fuel competitive with other fuels in the market, and the second price may vary from section to section of the county and in accordance with local conditions.

There is nothing new at all, in the plan of charge which I have endeavored to outline; it has been prevalent in the electrical industry for years, and a great deal has been accomplished in that industry by reason of their ability to fix their charges so that each and every consumer each and every month paid his fair proportion of the overhead charges which has been occasioned by each and every consumer alike, and further, by reason of the ability of the electric industry to easily establish such rates; we see through the entire country the establishment and enormous growth of electrical plants, and they are giving the average consumer a great service at prices well within their ability to pay, and at the same time are able to, by reason of covering their overhead charges by a charge made against each and every consumer, to furnish to the large users of their service a greater service and at a price which makes it competitive, and enables this industry to market enormous volumes of their service. Just why a full appreciation of this matter has not yet been had by the gas industry in general, is beyond my comprehension.

There are certain things to be considered by the gas operator in his attempt to reach a practical method or charge that cannot be used as an argument either to the public or to the regulatory bodies, nevertheless they are of great value from a practical standpoint in consideration of this subject. I again refer you to the fact that three-fourths of the natural gas consumers are Domestic consumers and use gas in residences.

The first few thousand cubic feet of gas used each month in a residence is for domestic purposes, and occurs each month for the same purposes during the twelve months of the year, and each day this use of gas includes gas for lighting, cooking, water heating, laundry, etc. If artificial gas can be used by consumers for the purposes above mentioned at a price for the first thousand of $1.00 as commonly sold, then it is evident from the above and any careful consideration of the subject that a price three times that which is now ordinarily charged for natural gas might be fixed and still retain a competitive situation.

After having made these charges for the first few thousand cubic feet of gas for resident consumers it is practical to fix a charge or rate for the remaining part of the gas sold to them at a price that will make the price attractive for additional use of gas that may occur in the home, and which uses are practically entirely embraced in the seasonable use of gas for heating purposes. To any industrial consumer or any large consumer of gas, the matter of price for the first few thousand cu. ft. of gas is practically of no consequence, provided the price for the bulk of the gas used is placed at a figure that makes it profitable for their use as a fuel, or other purposes required, and right here, is where our electrical brethren get in their heavy work, for they have so arranged their rates that they are enabled to offer to the larger consumers attractive prices, — this may easily be done in the gas industry, and after the consumer cost and overhead charge has been practically taken care of within the price of the first few thousand cubic feet of gas delivered to each and every consumer, or it be covered by a service charge outside of the price of gas, then it is practical to so fix the second or third rate that may be established, that they can be competitive.

Summing it all up, it remains for the seller of the gas to study his market to determine what quantity he is able to supply and fix his price so that he may obtain the maximum sales of gas to that market he has determined to occupy.

S. M. Douglass, *Chairman,*
Alfred Hurlburt,
Committee.

President Cartwright: Gentlemen, you have heard this very interesting and painstaking report on this all important subject. I think we should have a free discussion of it. At the same time our time is rather limited. However, we would like to hear from a few of the gentlemen who have had more or less experience on the matter of rates. Mr. Daly, will you give us the benefit of a few remarks on this all important subject? You probably have had more to do with rate making than anybody else in this country.

Mr. Martin B. Daly: Mr. President and gentlemen, I do not think I am very well qualified to pass any criticism — if any were needed — upon a paper of this kind. In fact, in view of the comprehensive and thorough report, further remark seems unnecessary.

The obligation of the consumer to the company is fully as great as the obligation of the company to the consumer and Mr. Hurlburt has defined that clearly and emphatically. So long as the company does not make an overcharge above the amount which it should have for overheads in furnishing the gas to the consumer, no injustice is done and it is the duty of councils and public utilities to see that companies are given that amount at least. We know that every gas company is furnishing gas at a loss to the small consumer. The larger the company, the more people they are carrying at a loss, especially in cities where people are now resorting to the apartment house heated with steam, hot water or coal or something of that kind. Many cities are engaged in heating buildings with hot water or steam heating appliances which the taxpayers very liberally help them to conduct and thus deprive the city of the revenue that naturally comes from a taxpayer where the business is conducted by a private corporation. We can not compete with that kind of a proposition, but the city at the same time attempts to force us to furnish gas at a fixed price. Very recently I had an experience with a council, and four of the members told me they would not vote for the ordinance if there was a minimum charge attached to it; that none of them paid over thirty cents per month and they did not propose to increase their own bills. Now as a result of that, we were obliged for many reasons to waive the usual conditions that we insist on in such ordinances because we were furnishing a very large number of consumers that did pay us and so for the time being, at least, thought we could afford to make a present to these gentlemen of the service that the company was rendering them.

I think in unison with everybody here that Mr. Hurlburt as well as his associate on the committee is entitled to a vote of thanks for he has evidently given the matter serious thought and study. I thank you, gentlemen. (Applause).

PRESIDENT CARTWRIGHT: Any further remarks on this report? Mr. Krick, I will call upon you.

MR. KAY C. KRICK: Mr. President, I hardly expected to be called upon. I think that I am on record pretty thoroughly in last year's meeting with reference to my views on this subject. In a general way they correspond with those in the report and I certainly hope to see the day when gas companies generally will be able to secure rates which will be more nearly commensurate with the service rendered.

PRESIDENT CARTWRIGHT: Mr. Maxon, I will call upon you next.

Mr. J. H. Maxon: The main purpose of an article on rates may be to direct the attention of operators to the possible methods of correcting the inequalities of their rates (I assume that all the operators are perfectly aware of these inequalities), but all such arguments ought to be carefully construed with reference to the impressions likely to be created upon public officials who are charged with the duty of regulating rates. Public officials are always for the "under dog." It is impossible to make the great corporations engaged in the distribution of natural gas appear in the aspect of the "under dog," but I think some effort ought to be made to emphasize more strongly the *public interest* in an equitable adjustment of the rates. It will be far from sufficient to prove the injustice of the low price to the small consumer. The association of ideas between the small consumer and the poor man is almost ineradicable, and the inclination of the public official to permit injustice in favor of the poor man, is, with the exception of judges, almost universal. In other words, to prove that the small consumer is getting service at a lower cost and much cheaper than he ought to get it, is to incline your public officials to act for the continuation of such a system. The point of my suggestion is that more of an effort must be made to give the public officials some good ground to stand upon politically.

The *theory of regulation of so-called public utilities* — gas, electric lighting, and urban transportation — is that prices should be controlled and fixed so as to allow a fair rate of return upon the actual value of the property used and useful. The public gets the benefit of any reduction in costs. Owing to the uniformity of demand for such service, such enterprices can endure, better than almost any other kind of business, this regulation. Ordinary business could not endure it, more on account of fluctuating demand than competitive conditions. Everyone recognizes that the law of supply and demand is the controlling law of business.

Upon reflection, anyone can realize that natural gas operates as distinctly under the law of supply and demand as any competitive business: Its competition is with coal, wood, oil, artificial gas and electricity. It can sell its product only when the service rendered by it is equal to, or less than the service rendered by any other fuel. To be obliged to dispose of any part of its product at less than cost, obviously necessitates the selling of some other proportion of its product at more than a fair rate of return. With respect to the natural gas, this merely means that to save a few cents per month on household expenses might require the placing of a rate for industrial purposes so high as to compel the factories to use coal and to compete at a disadvantage with other commodities. Moreover, if it can be proved that the domestic customers are being served at a loss, thereby necessitating an unfair profit on the manufacturing, or larger consumers, it can easily be shown that such a rate violates the public utility commission laws, which require a fair rate of profit from all consumers.

But two factors enter into the discussion of natural gas that do not enter into the artificial gas problem, namely, that the production of natural gas is a mining operation, attended by many hazards as to render it impracticable to accurately determine the cost of its production. The other great principle as affecting the public, is the *principle of conservation.* We hear a great deal about it these days. I need not shed tears, but any good politician could paint a pathetic picture of what has happened, and of what is happening, in the wilfull waste occasioned in the early days by carelessness, and in these days by these inequitable rates. Natural gas is a vast source of wealth. Shall the present generation exhaust it in order to make a maximum saving over the minimum number of years? The answer might be "yes" if it were not for the fact, as can be easily shown even to the public, that very low rates result in very wasteful use. From the standpoint of the public alone, and disregarding the interests of the pipe line carrier, the rates for natural gas must be *high enough to necessitate economy* in the use of it through the most perfect appliances and the complete utilization of all heat generated, and *low enough to displace competing fuels* to an extent at least sufficient to pay a fair rate of return upon the investment made in producing and carrying the gas. I believe that this is a proposition that is economically sound. Proposals along these lines would afford a better basis for public defense of an adjustment of rates than any argument based upon equities.

The truth of the matter is that natural gas is, and must be, sold under strictly competitive conditions. It really ought to be sold with the utmost freedom, subject only to the general principle that it should be sold at uniform rates, and particularly, at the same rates to people engaged in the same kind of business. The fact is, that the public interest in gas rates is that they should be sufficiently low to secure economy and high enough to prevent waste. The prevention of waste can be brought about only by the use of economical appliances. If the rates are so low that economy can be secured without the use of the best appliances, then the gas is wasted, and so I say that rates ought to be high enough to encourage the use of the best and most economical appliances; otherwise, to save the cost of appliances, consumers will burn the gas wastefully.

In addition to what I have said I want to bring into this discussion something that has been referred to in the report submitted, which I think is of the very greatest importance to the industry, namely the matter of the classification and analysis of accounts. A considerable amount of work has been done along this line, but there remains a great deal to do yet in order that those engaged in the industry may be apprised of the real facts concerning the results that are obtained in the sale of natural gas. Among other things we are all confronted, every time we make a proposal for adjustment of rates, by the statement that the small consumer is a poor man. Those who have undertaken to find out the facts about this matter uniformly state that such is not the case, and wherever companies are progressive enough to adopt a plan of analysis of their sales I suggest to them that they make an additional effort to discover who may be the small consumer. From my own experience I will assert that it will be found that he is not the poor man.

In regard to the matter of any proposals that may be now before the people, and may hereafter be made with reference to adjustment of rates, the suggestions that have been made as to informing the public preliminary to such proposals certainly will bring results that cannot be obtained if the matter of the adjustment of rates is simply thrown before the public without having previously educated the public through proper means and given them the information that is required. Incident to that I may say that we cannot expect regulatory bodies, either city councils or state commissions, or what not, to support us in our proposals if they are not aware that the proposals we are making will receive the support of the public. If we put ourselves in the position of the men who are in these city councils or state commissions, we will all realize that we would not contend against public opinion, even though we knew the proposals that were being made were proper.

Further, with regard to the matter of the adjustment of rates, and to bring before you the urgent necessity of immediate and continuous consideration by the natural gas industry of this problem, we only have to mention that we now find the conditions prevailing whereby the enormous quantity of natural gas marketed in this country brings into our treasuries about one hundred million dollars a year. If a calculation was made showing the number of heat units that we deliver for that one hundred million dollars, and it was further calculated as to what it would cost to manufacture a product in a stable gaseous form containing an equal number of heat units, it would be found that the cost of manufacturing the product and putting it in proper form for distribution as a stable gas that contained an equal amount of heat units might be three or four times as much as the amount we now collect for the gas we are selling. Again you might consider that out of this one hundred million dollars it is really collecting perhaps not over ten per cent, or perhaps ten to fifteen million dollars is collected for the gas delivered for domestic use other than heating. It is said that there are practically two million consumers of natural gas in this country. It is a safe assertion that over seventy-five per cent of these consumers are for resident premises, and I think it is a safe assertion to say that they do not pay out of the total collections for gas consumed over ten to fifteen per cent. Yet it is a fact, as is proven throughout the entire country in the marketing of artificial gas, that these same consumers can pay at least four times what they are now paying and yet find that the service cannot be duplicated without increasing their cost. I thank you. (Applause).

President Cartwright: Any further remarks on this subject?

Mr. Edwin Robinson: Mr. President, I move that a vote of thanks be extended to the Committee on Rates, and also to Mr. Maxon and the other gentlemen who have discussed the subject, and that, also, the report of the Committee be accepted and spread upon the minutes of the association.

President Cartwright: Do I understand that your motion also includes that the Committee be continued?

Mr. E. Robinson: Yes, and the Committee continued.

The above motion having been duly seconded was then unanimously adopted.

President Cartwright: The report of the Ways and Means Committee for increasing the scope and usefulness and efficiency of the Association will not be made until tomorrow morning. So, according to the regular program, the next paper will be by Mr. Reeser on the subject: "Value of Leaseholds for Rate Making Purposes."

Mr. H. C. Reeser, of Pittsburgh, Pennsylvania, then read the following paper:

VALUE OF LEASEHOLDS FOR RATE MAKING PURPOSES.

H. C. REESER.

As an introduction, I will quote from Mr. Samuel S. Wyer's admirable paper on the "Principles of Natural Gas Leasehold Valuation" as follows:

The magnitude and economic importance of the problem of correctly valuing natural gas leaseholds become evident when we consider that:

(a) Natural gas is handled in 55 per cent. of the gas distributing plants in the United States.

(b) Present known natural gas acreage forms 47 per cent. of the total known mineral-land acreage in the United States.

(c) Five acres of land are now required to protect and maintain continuous service to each of the 2,000,000 domestic natural gas consumers in the United States.

(d) The cost of acquiring and maintaining this acreage of an expendible resource represents a substantial part of the cost of the natural gas service to the consumer.

At the third annual meeting of the Ohio Gas Association held in Columbus on March 24th and 25th, 1914, at which meeting there were present representatives of the public Utilities Commission of Ohio, the question of valuations was discussed, but no definite action was taken at that time.

Some time later in 1914 a joint meeting of The Public Utilities Commission of Ohio and The Ohio Gas Association was held at the office of the Commission in Columbus, Ohio, at which the valuation of leaseholds was under consideration.

The importance of such valuation was fully realized by both the gas men and the Commission, and the Commission requested the Association to select a Committee to formulate a plan for valuing natural gas leaseholds and report to the Commission.

President Garard appointed as that Committee, Messrs. M. B. Daly (Chairman), W. Y. Cartwright, L. G. Neely, K. C. Krick, and George Heard.

Mr. Heard has since passed to the great beyond, and Mr. Daly resigned as a member of the Committee, and the writer was appointed as his successor.

After numerous conferences, a plan of valuation was agreed upon and a report made to Mr. Garard, President of the Ohio Gas Association, who has submitted it to The Public Service Commission of Ohio.

While this report was primarily written to cover conditions in Ohio, I believe that by simply changing the name of the State, it will apply to any State in the gas zone, and I therefore respectfully submit herewith the report of the Committee, which is as follows:

PITTSBURGH, PA., March 22nd, 1916.

MR. J. M. GARARD,
President Ohio Gas Association,
Columbus, Ohio.

DEAR SIR: — Your committee, heretofore appointed by the Ohio Gas Association, to formulate a plan or method of valuing each.

natural gas leaseholds and rights for rate-making purposes, beg leave to submit the following report:

The efforts of this committee have been directed towards establishing a practical working plan for valuing natural gas leaseholds and rights for rate-making purposes; it being assumed that the legal right of the particular company under investigation at the time to have such leaseholds and rights valued for rate-making purposes as a part of its property devoted to public use, is already thoroughly established.

In making such valuations we believe that the production should be used as a basis, together with other important factors that are familiar to all natural gas operators.

To illustrate:

All the large natural gas distributing companies are buying more or less gas from producers in the field, the average price now paid being about six (6) cents per thousand cubic feet at the well. One of the producing companies in Ohio in the year 1915 produced from 823 wells, on 58,781 acres of developed territory 12,892,385,000 cubic feet, which at the prevailing price of six (6) cents per thousand at the well would be worth $773,543.10. This would average a production of gas of the value of $13.16 per acre for the year, and assuming the average life to be five years gives a value of $65.80 per acre. It must be understood, however, that this is merely an illustration as a basis of computation and is not considered conclusive of value for the reason that it is based upon the cost of gas at the well and does not include anything for reserve or protected acreage.

With the foregoing method of computation as a basis, we believe that the following factors should also be taken into consideration, and we therefore recommend that in making such valuations, that the leaseholds be grouped into the following classifications:

1. Producing leases, or those on which wells have been drilled, thereby demonstrating the existence of gas.

2. Developed leases, or those upon which wells may or may not have been drilled, but adjoin or are close to leases upon which wells have been drilled.

3. Reserve leases, or those which are held, whether drilled

or not, as a reserve acreage to maintain or replace the present supply.

The leases embraced in groups 1 and 2 will ordinarily be of the same value. Leases in group 3 will ordinarily have a value equal to the amount of money invested therein, and may, and quite often do, owing to proximity to established producing fields, have a value greatly in excess of the cost to the company.

The term "value" is used herein as synonymous with purchase and sale value or exchange value.

The reproduction method of valuation is impracticable because it is impossible to reproduce natural gas leaseholds as such leaseholds represent an interest in a particular section of the earth's surface and the natural gas thereunder.

Neither is it possible to establish a market price in the sense that there is an established market price for corn, wheat, iron, or other products which are constantly changing ownership in the daily exchange of products in the commercial world.

In our judgment there is but one method by which values of such leaseholds may be determined with any reasonable degree of accuracy, and that is by the testimony of skilled, experienced natural gas men after examination of the particular property under appraisal with due consideration of all the salient elements which enter into such an appraisal. In our opinion there is absolutely no difference in principle between appraising natural gas leaseholds for rate-making purposes and appraising the same leaseholds for purposes of purchase and sale as between buyer and seller.

In making an appraisal of natural gas leaseholds a skilled and experienced gas man must take into consideration the following elements:

1. The amount and extent of acreage embraced in the leases under appraisal, whether they are blocked up in one extensive area or consist of scattered tracts of smaller area through a given territory.

2. Proximity to market; whether the market is relatively close or at a distance.

3. The market demand; whether the market in which the gas is sold or to be sold is largely of a domestic character or

whether or not a considerable volume must be sold for manufacturing purposes; if domestic, whether or not the population is prosperous and of good earning capacity and likely to demand and use considerable quantities of gas.

4. Volume of flow; the amount of gas which the wells will produce whether relatively large or small.

5. Pressure; whether the rock pressure is high or low, as both pressure and volume have a very large influence upon the cost of producing the gas in that wells of relatively small volume and pressure require a greater number of wells and larger transportation facilities to supply a given number of consumers.

6. Thickness, depth and character of sand in the containing reservoir as the volume and pressure of gas depend very largely upon the thickness of the sand and whether the sand be loose or coarse in texture.

7. Probable extent of the field, as a block of a thousand acres in isolated area will be of less value than the same acreage in territory capable of extension by the accumulation of other leases and further drilling.

8. Competitive conditions of field, as a field in which one company holds leases not affected by the drilling of other companies is of more value both to the company and to the consumer than one in which several companies are operating, in that the company is thus enabled to conserve its supply to the fullest extent possible and prevent waste, all of which is in the direct interest of the public, as the public has a direct interest in prolonging the life of the gas producing fields.

9. Cost of drilling wells, whether the gas is found in a gas producing sand relatively near or a considerable depth below the surface of the earth, etc.

10. Probable life of field, depending upon depth, thickness and character of sand, volume and pressure.

11. Proximity to developed territory. This applies particularly to undeveloped leases, and is largely dependent upon the development of territory in the immediate vicinity.

12. Character of the gas, whether containing sulphur or other deleterious substances, whether dry gas or coming from wells affected by salt water.

There are probably other minor factors which the experienced and skilled gas man would take into consideration in appraising any given property, but we believe the foregoing to be the salient features.

In conclusion we desire to reiterate that the only practicable method of valuing such leases or appraising them for rate-making purposes is to obtain the judgment of men skilled and experienced in the natural gas business, based upon investigation and consideration of the factors above enumerated. We are confident that the men who have devoted their capital and skill for years in the development of the natural gas business in Ohio and have built the business up to the point where it is directly affecting to a large extent the comfort and welfare of three and a half million people, residents of the state, will be willing at all times to give their best services to the Public Utilities Commission in endeavoring to establish a just and true appraisal in any rate case pending before the Commission which may require an appraisal and valuation of natural gas leaseholds.

Respectfully submitted,

H. C. REESER, (Chairman)
W. Y. CARTWRIGHT,
K. C. KRICK,
L. G. NEELY,
Committee.

DISCUSSION.

PRESIDENT CARTWRIGHT: As a member of that Committee referred to by Mr. Reeser in his paper, I wish to say that the credit for the report of the Committee is all due to Mr. Reeser. He did practically all the work in connection with it. I do not want to take away credit from any of the other members but I think they will join me in that statement. The natural gas company without a leasehold would be just about the same as a railroad company would be without a track. After all I believe that in leaseholds consists the basis of all of your investments in all of your companies. Without them you have not got much of a natural gas company. We have with us today three or four men I know who have had pretty wide experience, particularly along the line of leaseholds, and I would like first to ask Mr. McDowell if he will not lead the discussion on this subject.

Mr. J. C. McDowell: Mr. President and Gentlemen; I have listened to the excellent paper just presented by Mr. Reeser, embodying the report of the Committee just referred to, with very great interest indeed. It correctly states that there is no differences between fixing the value for rate-making purposes and arriving at the value for the purpose of purchase and sale between buyer and seller. This should be done by men experienced in the business.

The main points to be considered in arriving at the value of the property are well covered in the report. The second point — proximity to market — is two sided. There is such a thing as being too near the market. I would place a much higher value on developed acreage than I would on the same acreage within one or two miles of the city. The reason is obvious to any experienced operator.

In determining the value of a large acreage, I would emphasize the importance of the development thereon, i. e., whether or not the wells are widely distributed over the acreage.

Another strong element to be considered is the historical characteristic of the sand, or sands, in which the deposit is found. For instance, we all know the wonderful lasting, productive qualities of the Clinton sand in Ohio, and the Medina sands in Western New York and Canada, while the history of production from the Trenton rock formation is also well known. In Ohio the characteristics of the Berea grit formations are also familiar to most experienced operators. In the Appalachian region I know of one well that produces gas in paying quantities from nine different sands. We know from experience that certain of these sands are dependable, while others are precarious. In Oklahoma and Kansas it is not unusual for gas to be found in paying quantities in three of four different sands in the same well, and wells have recently been drilled in Oklahoma having volumes from ten to thirty million feet from each of three sands varying in depth from six hundred to three thousand feet.

In Kansas we have an element to be considered that is not mentioned in this report, viz., the B. T. U. contents of the gas.

We find gas in quantity in wells from certain formations in Kansas containing from sixty to ninety per cent of nitrogen. Some of this gas cannot be burned at all to any advantage. There is a large volume of gas developed that contains less than seven hundred B. T. U., in fact we have gases varying from two hundred B. T. U. to one thousand or more.

There are so many elements to be considered in fixing the value of lease acreage that it requires very careful invstigation by men of broad experience to determine values. However, such values can and are being determined every day, and capital is ready to make extensive investments on the strength of the valuation of the leasehold acreage, for the value of the leasehold is the basis of all successful development and exploitation of natural gas propositions.

PRESIDENT CARTWRIGHT: Mr. Seyffert, have you any remarks to make on this report, or on this paper?

MR. L. A. SEYFFERT: Mr. President and Gentlemen; I do not know that many things can be added to the very comprehensive paper and report presented by Mr. Reeser, and the excellent discussion of it by the members who have already spoken. I think that the paper and the discussion have been very thorough and instructive, as well as interesting. It seems to me the gist of it all is that there is no general rule that can be laid down for the valuation of leaseholds as applying to different companies in different localities. The main point seems to be pretty well brought out in this one paragraph in the paper by Mr. Reeser which I will take the liberty to re-read:

"In our judgment there is but one method by which values of such leaseholds may be determined with any reasonable degree of accuracy and that is by the testimony of skilled, experienced natural gas men after examination of the particular property under appraisal with due consideration of all the salient elements which enter into such appraisal."

A great many of these salient elements have been recited here in the paper, and as Mr. McDowell has suggested, there are still others that have not been recited and no doubt each company has its own peculiar conditions which must be taken into consideration in valuing leaseholds, as, for instance, the proximity to market and the other elements of being too close to market, making competitive conditions quite different than if the field were farther away. I do not know of anything else that I could add except this general remark, not to fall into the error of trying to apply any set rule to govern any number of companies, or in fact even a single company, or to govern for any period of time because the conditions of the particular company may change from year to year.

PRESIDENT CARTWRIGHT: Any further remarks? I might add a word there. I have been in pretty close touch with Mr. Reeser's work in connection with this report. He had in mind in submitting it not attempting to establish a basis whereby any engineer without any experience in the gas business could go out and attempt the intricate job of appraising natural gas leaseholds. He aimed to convince the Public Utilities Commission of Ohio that it should be done by men skilled in the natural gas trade and not by men who have had no experience with it. I think that is the greatest protection we have, in the matter. It must be done by men who had had wide and lengthy experience. I will be glad to entertain a motion of thanks to Mr. Reeser for this most excellent paper.

MR. JOHN M. GARARD: I move you, Mr. President, that a vote of thanks be tendered to this Committee.

PRESIDENT CARTWRIGHT: Pardon me it is not a committee. It is a paper, prepared and furnished by Mr. Reeser.

MR. JOHN M. GARARD: I beg your pardon. I think the names are all there of the Committee who signed the report, and that as a matter of fact, it was the report of that Committee. I hate to take exceptions to a statement by the President, yet I still think it was a report. It is the report of this Committee that I appointed as President of the Ohio Association, and therefore I insist on my original motion. (Laughter and applause).

MR. KAY C. KRICK: I second the motion.

PRESIDENT CARTWRIGHT: It has been moved and seconded that a vote of thanks be extended to Mr. Reeser for this most excellent paper,—not report,—(Renewed laughter and applause).

The above motion having been duly seconded was then unanimously adopted.

President Cartwright: We will now have the report of the Committee on Conservation, of which Professor White is Chairman.

Prof. Israel C. White: Mr. President and Gentlemen; probably many of you here are unacquainted with the origin of the conservation movement. We owe it largely, — the beginning of it at least, to the action taken by our distinguished Ex-President, Mr. Roosevelt. Soon after his inauguration for the regular period for which he was elected he realized the value of advice — and that is one of the peculiarities of that remarkable Ex-President. Although he seems very impulsive in many directions, and you would think that he would be like a "bull in a china shop" yet he has that remarkable faculty of calling to his service experts. For instance, when he wanted advice on finances and what best to do for the financial interests of the country, he did not hesitate to call upon his friend the late J. Pierpont Morgan in order to get the best advice there was. Thus, instead of being erratic he was in fact one of the most conservative men in his actions we have ever had in the White House. Soon after his inauguration he realized the necessity of advice on various important problems and he called to his service what he denominated the National Advisory Board. On that Board, consisting of about one hundred people, more or less, were citizens from all parts of the country. They represented the great scientific organizations of the country. They represented the great industrial organizations of the country. An eminent citizen of Pittsburgh was a member of that Board, Mr. Julian Kennedy, who you all know. There were also men like the late Dr. Holmes, and W. J. McGee, and several members of the industrial organizations, financial institutions, insurance societies, and so forth. As I say, he called to his service this Board in an effort to get advice from every direction as to what was best to do for the country. Your speaker was called upon to serve as a member of that Board, and living here in this center where I had seen so much waste, not only of natural gas, but of coal gas as well, and of coal itself, I regarded it as my duty to bring to the attention of that great organization which met in an advisory capacity with the President to ascertain what to do for the best interests of the country, — to call to the attention of that Board and to the President, the great waste, not only of natural gas, but of coal and other natural resources of the country, including timber, and lumber waste. In that organization was the late Dr. Holmes. My talk on that question of conservation impressed him greatly and later he took up the study of the matter while acting as chief of the Technological Department of the United States Government Survey, and largely through his work the conservation measurement was started, so that Dr. Holmes was the real author of the movement for conservation. You know his work. You know what he has done, not only for the conservation of natural resources in the founding of this great Bureau in Pittsburgh, the greatest industrial center of the world, but all over the country in establishing these experiment stations which the last Congress passed the necessary legislation to inaugurate, and which it is hoped the present Congress will carry into effect with adequate appropriations. The President realized from the advice that was given him, the necessity of doing something to push along this work, and the Congress of Governors — the first in the history of the country, — called in May, 1908, — might be said to have grown out of the work started by this first Advisory Board. At that Congress I was again called upon by President Roosevelt to speak on the subject of the waste of our fuel resources and some of you probably have read what I had to say on that subject. So it has fallen to my lot to talk on this question several times. An Ex-President of this Association today reminded me that I was nearly a "back number" and that to his own personal knowledge I had been writing and talking about the gas business for about a third of a century. It is exactly a third of a century since I took up the study of this question. Back in 1882 I was called upon by a citizen of Pittsburgh to see if there was not some method whereby the great waste of capital in exploring for natural gas might be avoided; to see if geology could not bring some message to the driller, to the capitalists who were exploring for natural gas so as to limit the ultimate expense. The results of that work I committed to publication June 26th, 1885. I discovered from that preliminary study what I regarded as a good guide. I did not keep it to myself after it had been tested — to my satisfaction, but I gave it to the world. It appeared in a weekly publication called "Science" which reaches all parts of the country. That discovery most of you know as the anticlinal theory, or the structural theory for the occurrence of oil and gas. At first it was ridiculed, even by some of my brother geologists, and most of the oil and gas fraternity did not take any stock in it. They rather resented the fact that a University Professor — which I was at that time, — should break in upon their previous theories, and hence in a demonstration which was undertaken in the matter by myself I think that most of them thought I would fail, and the majority hoped I would fail. So that in the first experiment where I laid out an oil field, or where I thought there was one, on this theory, thirty-five miles in advance of developments at the celebrated Manning experiment, I am sure that most of them thought I was ten miles too far west, but when it came in an oil well some of them began to take notice. However, it has only been within the last very few years that geology has come into its own in the conservation of capital, — in the effort to limit the area where prospective oil and gas territory can be found. I was talking to a gentleman, (Mr. Johnson of the Philadelphia Company), yesterday who has recently come from the Irvine Field of Kentucky and he says they have there one of the most beautiful anti-clinas he ever saw. Mr. Diescher, my associate on this committee, comes up from Texas with the same message, and I hope Mr. Diescher will show some of you the structural features that he has encountered and mapped out in these Texas pools. The same is true of Oklahoma. In West Virginia you have only to inspect our geological maps where the structure is put down for your convenience and guidance to be assured of the truth of the structural theory. Many of my friends have tried to get away from it. Some of them have said that it was only a coincidence, that it was capillary attraction or something else besides structure that governed the occurrence of commercial pools of oil and gas. My friend Mr. Munn in the nearby territory tried to get away from it, but I noticed that Mr. Munn in making locations for oil and gas since he left the Government service, nearly always uses — in fact always uses the structural theory so that your speaker has done something outside of talking about conserving natural gas and other resources, in conserving capital, although at times in my own State it has been very discouraging. I am at the head of an organization there that I am sure any of you who have read our publications know and realize has done a great deal for the oil and gas business, and sometimes in trying to keep that organization alive to continue the work of conservation for the oil and gas fraternity largely, as well as the coal industry, I have met with great discouragement. At the last session of the Legislature, Mr. Chairman, as you may know, and as many of you know, although I give my services and three-fourths of my time to the work of our State Geological Survey without a cent of salary, and to the neglect of my own private business in which I might have gathered many fortunes, the appropriation for this survey was cut down at the last session of the Legislature, and we only received one-half its usual amount, and indeed there was an effort made to extinguish it entirely, and I fear that some of the oil and gas people who do not, — or did not then, at least, appreciate what I have tried to do for them, — aided in that work. I have forgiven them, because I do not think they realized what they were doing.

Now, Mr. Chairman, as one of my friends has said, I have been in the service of conservation a long time, so long that I think a younger man should take it up. I think when this report is read that Mr. Diescher, a much younger man than myself, and a very active man on this Committee, should be appointed as its Chairman. I have so many calls for public service that it is impossible for me to devote the time to the work that it demands. I am a member of the Federal Trade Commission that tries to look after the business of the entire country. I have been made Chairman of the West Virginia State Directors for Industrial Preparedness, and there are so many different lines of service that I have been called upon to perform that I have really not the time to give this important question the work and study it deserves. So that in reconstituting this Committee I trust you will appoint at its head Mr. Diescher, who has contributed a very valuable paper to this report.

Prof. Israel C. White then read the following:

REPORT OF THE COMMITTEE ON CONSERVATION.

Mr. William Y. Cartwright, *President,*
Natural Gas Association of America.

Dear Sir:—

It has been found impossible to secure a meeting of the members of the Committee on Conservation previous to the assembling of the Association at Pittsburgh. In view of this fact, the Chairman of the Committee a few weeks ago asked the several members to submit communications on the subject which might be considered in the nature of a "round robin" instead of simply a report by the Chairman. To this request two out of four of the members replied and sent letters. One of these was Mr. Alfred J. Diescher, of Bartlesville, Oklahoma, the accomplished Vice President and General Manager of the Kansas Natural Gas Company, who gave the Association such an interesting and illuminating talk on the subject of gas conservation at the Cincinnati meeting last year. The letter of Mr. Diescher contains so much of desirable information on the subject of conservation that it is herewith submitted in full as a part of the Chairman's report:

"Bartlesville, Oklahoma,
April eighteen, 1916.

"Dr. I. C. White, *Chairman,*
Conservation Committee,
Natural Gas Association of America,
Morgantown, West Virginia.

"My Dear Dr. White:

"Referring to your request for a statement as to the conservation of natural gas in the Mid-Continent field, I take pleasure in writing as follows:

"The new conservation law in Oklahoma, which is probably the most effective of all natural gas conservation laws yet passed and placed in force in the United States, became effective upon September first, 1915. Under this law, and the inspection by the

Corporation Commission, real effective conservation has been brought about. In the large new pools recently opened at Blackwell, where four or five large gas sands are passed through in reaching the oil productive sand, at 3400 feet depth, the greatest work has been accomplished in effective conservation.

"In such fields as the Shamrock Pool, south of Cushing, where both oil and gas are developed, and in many newer operations of the state, the most noted thing is the absence of blowing gas.

"Oklahoma operations are conducted under two classes of leases; namely, Departmental leases and Commercial leases, the former covering lands of the Indians, whose leases are subject to the approval of the Secretary of the Interior, and the latter class covering the leases on lands owned by white people or Indians whose transactions are not subject to the approval of the Secretary of the Interior. The state conservation law controls conservation on commercial leases, while the conservation regulations of the Department of the Interior are effective upon Departmental leases. The Federal Government and the State Government have independent inspectors, seeing that the conservation laws are carried out.

"Fundamentally both laws require the sealing of gas, oil or water in the sands in which they are found, preventing an intercommunication from one sand to another. The purport of the bill is to limit the operation of the well to one sand only, leaving the operator to select the sand he desires to develop, and to effectively seal off all other sands. This has brought about what is known as the mudding in process, whereby a column of mud fluid is entrapped behind the casing, counterbalancing the pressure of the gas, oil, or water contained in any sand, subject to the control of this column of fluid. At first there was considerable opposition on the part of the operators, to this method, but after several months operations the opposition has greatly subsided, and the oil operators are, as a general rule, working toward conservation of natural gas.

"In the Blackwell, Oklahoma, field, volumes of thirty to thirty-five million cubic feet of gas, under pressures as high as 1300 pounds, have been encountered, and are being successfully mudded off and drilled through. Similar wells, up to pressures of 1000 pounds, are encountered in the Shamrock Pool, in the Cushing field. Here, very little gas is escaping to the atmosphere, many of the wells having been mudded off in the gas sand, and drilled to deeper depths for oil. Such wells as have not been mudded off are feeding into the gas lines, as gas wells.

"One company in Kansas and Oklahoma have mudded over about forty gas and oil wells, drilling through to reach lower sands, and it has been found after extensive experiments, that it is cheaper to drill wells under the mudding process than under the old method of casing at the various sands, and permitting the casing to remain in the well. In the mudding system, a great amount of the casing is pulled, especially the larger sizes, immediately after the well is drilled in, making this casing available for use in other wells, thereby reducing the cost, or investment, as against the old process.

"In the Blackwell field there have been several tests drilled recently, with the Rotary Drill, or Circulating System. So far, the Circulating System appears to be very successful in closing off the gas formations passed through without permitting any of the gas to blow to the atmosphere. It also appears to be very successful in permitting the carrying of a string of casing to much greater depths than under the standard system of drilling. In one instance 12-inch casing was set at seventeen hundred feet depth, which is almost double the distance in the earth to which twelve-inch casing has been set heretofore in the Oklahoma fields.

"This is of great importance, for it permits of drilling much deeper wells on a commercial basis than has been heretofore possible. In fact, the showing of this test has been so satisfactory that three of the largest operating concerns in the field have announced publicly, before the Corporation Commission, that it is their intention to extensively try out this system with a view of adopting it as their standard method of drilling in that field.

Recently the Oklahoma Corporation Commission held a hearing at Blackwell, Oklahoma, to have the expressions from the various operators as regards the Commission issuing an order enforcing the drilling of oil wells through gas sands, in the Blackwell and Cushing Fields, by means of the Circulating System of drilling.

"One other element, which enters greatly into the adoption of the system of counterbalancing the gas pressure by mud fluid, whether with the ordinary mudding process, or by the Circulating System, is that the drillers are taking the view that it has been proven that it is not necessary for a driller to operate over a blowing gas well, with its consequent danger as regards life and injury, and the attitude is fast becoming assumed by the drillers of declining to operate over such wells, they insisting upon the use of the mudding system.

"The outlook for natural gas in Oklahoma was never better than it is today, and with two of the leading fields, each of great extent and enormous volumes of gas, standing out as examples of effective conservation, the gas operators, and the pipe line companies feel for once the business has been placed upon a more secure foundation as regards the life of the supply.

"The operations have proven beyond a doubt that conservation can be had, and without great interference with the oil production if both the oil and gas operators cooperate toward that end.

"Great credit is due to the Corporation Commission and its inspectors, and the Indian Department and their inspectors, for the successful results being accomplished.

"There is closed in today, in Oklahoma, by mudding, somewhere between five hundred million and one billion cubic feet of natural gas, open flow, which has been developed since September last, and which no doubt would have been blown to the air and wasted as in the past had it not been for this conservation law.

"This law has for its basis, as a matter of equity, that the pipe line companies will prorate their purchases of gas among the producers in a pool, thereby giving them the largest market possible, to give them an income on their investment, as encouragement for cooperation in gas conservation.

"As regards the state of Kansas, there has not been very much gas development there of recent years, most of the production being from the remnant of the old depleted fields. However, during the past year, new wildcat wells have been brought in, both for oil and gas, and the activity of this period forecasts great development, especially wildcatting during the next year or so to come. There is no effective conservation law in Kansas. In fact, the law, as framed today, permits of blowing of gas to the air, provided continuous drilling is being carried on. There is no question, however, as new development comes in, in Kansas, with the successful showing made in Oklahoma, that conservation laws will be passed when required, as Kansas has learned, through sad experience, the great cost of waste of gas resources, especially through the shortage of supply for the various towns and cities in recent years, brought about by the waste in the fields in northern Oklahoma and supplying Kansas towns.

"About the most important thing I can point out in this letter, relative to gas conservation in the Mid-Continent field is as stated above, that gas is being conserved in Oklahoma on a large scale, and through the cooperation of both the oil and gas producers, the success of which points out that there is no excuse for gas to be wasted in any state.

"I enclose, herewith, order No. 937, of the Corporation

Commission of Oklahoma, in the matter of Conservation of Natural Gas.

"Respectfully submitted.
"Yours truly,
"ALFRED J. DIESCHER."

From these statements of Mr. Diescher, it would appear that it has remained for one of the youngest states of our great sisterhood to set all of the others an example of effective conservation of both petroleum and natural gas as embodied in a practical statute of the state's organic law, while the oldest oil and gas producing states of the Union, like Pennsylvania, West Virginia, Ohio, and others in the East, have blundered along through over 50 years of wanton waste, without ever enacting or enforcing any efficient statutes or regulations to prevent or even check the greatest economic crime of the centuries; namely, the unbridled dissipation of the greatest natural gas fields of the United States, situated around and easily accessible to the manufacturing center of the world, of which the great industrial city within whose gates we are now assembled is the unrivaled metropolis.

The people of these older states in which the oil and gas industry originated, appear to have been satisfied to leave the matter of conservation of their natural resources of every kind, whether of oil, gas, coal, timber, water, or anything else, to the mercy and conscience of the operators whether private or corporate, so that practically nothing but the Common Law has barred the unrestrained waste of all natural resources in the entire Appalachian district, originally the richest in natural wealth of any like area on the earth.

The great corporations that have controlled alike the development of these natural resources, and the Legislatures which should have enacted efficient statutes for the protection and conservation of all, can certainly not look back with pride upon the long chapter of inexcusable waste which they have written into the natural gas history of the states in question. The only gleam of hope in this record of spoliation is that which has appeared within the last two or three years from the increased market value of natural gas itself, and from the discovery that the "casing head" gas escaping from the older oil wells was often of more value for the gasoline it contained than the oil itself saved from these wells, and hence the installation of compressing stations for the manufacture of "casing head" gasoline has in most cases resulted in not only conserving the escaping gasoline contents, but the saving of the residual gas for fuel purposes, and thus it is coming to pass that the natural laws of profitable business without the intervention of statutory regulations in West Virginia, especially, is doing much to conserve and prevent a former waste which is almost beyond calculation and belief. Whether or not the oil and gas interests of this state will ever permit the enactment of any proper legislation, as in Oklahoma and California, to curtail the very large unnecessary waste which still continues, remains for the future to decide.

OKLAHOMA LAW.

It might be of interest to quote here the essential provisions of the Oklahoma statute which Mr. Diescher testifies has worked out so admirably in Oklahoma, where the waste of natural gas was formerly nearly as great as that in West Virginia at its worst. The main points in the Oklahoma statute as printed in Order No. 937 of the Corporation Commission of Oklahoma, received through the courtesy of Mr. Diescher, is as follows:

"On March 30, 1915, House Bill No. 395, entitled 'An Act to Conserve Natural Gas in the State of Oklahoma, to Prevent Waste thereof, Providing for the Equitable Taking and Purchase of Same, Conferring Authority on the Corporation Commission,' etc., was approved. (1915 Session Laws, 398.)

"The bill is in part as follows:

"A. (Section 1.) That the production of natural gas in the State of Oklahoma, in such manner, and under such conditions as to constitute waste, shall be unlawful.

"B. (Section 2.) That the term waste as used herein in addition to its ordinary meaning, shall include escape of natural gas in commercial quantities into the open air, the intentional drowning with water of a gas stratum capable of producing gas in commercial quantities, underground waste, and permitting of any natural gas well to wastefully burn and the wasteful utilization of such gas.

"C. (Section 8.) That the Corporation Commission shall have authority to make regulations for the prevention of waste of natural gas, and for the protection of all natural gas, fresh water and oil-bearing strata encountered in any well drilled for oil or natural gas, and to make such other rules and regulations, and to employ or appoint such agents, with the consent of the Governor, as may be necessary to enforce this act.

"D. (Section 3.)

"(a.) That whenever natural gas in commercial quantities, or a gas bearing stratum, known to contain natural gas in such quantity, is encountered in any well drilled for oil or gas in this state, such gas shall be confined to its original stratum until such time as the same can be produced and utilized without waste, and all such strata shall be adequately protected and from infiltrating waters.

"(b) Any unrestricted flow of natural gas in excess of two million cubic feet per twenty-four hours shall be considered a commercial quantity thereof.

"(c) Provided, that if in the opinion of the Corporation Commission, gas of a lesser quantity shall be of commercial value, said Commission shall have authority to require the conservation of said gas in accordance with the provisions of this act.

"(d) And, provided, further, the gauge of the capacity of any gas well shall not be taken until such well has been allowed an open flow for the period of three days.

"E. (Section 4.)

"(a) That whenever the full production from any common source of supply of natural gas in this state is in excess of the market demands, then any person, firm or corporation, having the right to drill into and produce gas from any such common source of supply, may take therefrom only such proportion of the natural gas that may be marketed without waste, as the natural flow of the well or wells owned or controlled by any such person, firm or corporation bears to the total natural flow of such common source of supply having due regard to the acreage drained by each well, so as to prevent any such person, firm or corporation securing any unfair proportion of the gas therefrom; provided, that the Corporation Commission may by proper order, permit the taking of a greater amount whenever it shall deem such taking reasonable or equitable.

"(b) The said Commission is authorized and directed to prescribe rules and regulations for the determination of the natural flow of any such well or wells, and to regulate the taking of natural gas from any or all such common sources of supply within the state, so as to prevent waste, protect the interests of the public, and all those having a right to produce therefrom, and to prevent unreasonable discrimination in favor of any one such common source of supply as against another.

"F. (Section 5.)

"(a) That every person, firm or corporation, now or hereafter engaged in the business of purchasing and selling natural gas in this state, shall be a common purchaser thereof, and shall purchase all of the natural gas which may be offered for sale, and which may reasonably be reached by its trunk lines, or gathering lines without discrimination in favor of one producer as against another, or in favor of any one source of supply as against another save as authorized by the Corporation Commission after due notice and hearing; but if any such person, firm or corporation, shall be unable to purchase all the gas so offered, then it shall purchase natural gas from each producer ratably.

"(b) It shall be unlawful for any such common purchaser to discriminate between like grades and pressures of natural gas, or in favor of its own production, or of production in which it may be directly or indirectly interested, either in whole or in part, but for the purpose of pro rating the natural gas to be marketed, such production shall be treated in like manner as that of any other producer or person, and shall be taken only in the ratable proportion that such production bears to the total production available for marketing.

"(c) The Corporation Commission shall have authority to make regulations for the delivery, metering and equitable purchasing and taking of all such gas and shall have authority to relieve any such common purchaser, after due notice and hearing, from the duty of purchasing gas of an inferior quality or grade.

"G. (Section 9.) Before any person, firm or corporation shall have, possess, enjoy or exercise the right of eminent domain, right of way, right to locate, maintain, construct or operate pipe lines, fixtures, or equipments belonging thereto or used in connection therewith, for the carrying or transportation of natural gas, whether for hire or otherwise, or shall have the right to engage in the business of purchasing, piping, or transporting natural gas, as a public service, or otherwise, such person, firm or corporation shall file in the office of the Corporation Commission a proper and explicit authorized acceptance of the provisions of this act.

"H. (Section 6.)

"(a) That any person, firm or corporation, or the Attorney General, on behalf of the State, may institute proceedings before the Corporation Commission, or apply for a hearing before said

Commission, upon any question relating to the enforcement of this act.

"(b) Jurisdiction is hereby conferred upon said Commission to hear and determine the same, said Commission shall set a time and place when such hearing shall be had and give reasonable notice thereof to all persons or classes interested therein by publication in some newspaper or newspapers having general circulation in the state, and shall in addition thereto cause notice to be served in writing upon any person, firm or corporation, complained against in the manner now provided by law for serving summons in civil actions.

"(c) In the exercise and enforcement of such jurisdiction said Commission is authorized to summon witnesses, make ancillary orders, and use such means and final process including inspection and punishment as for contempt, analogous to proceedings under its control over public service corporations as now provided by law."

Mr. W. T. Griswold, the expert geologist for the great Philadelphia Company, of Pittsburgh, probably the largest supplier of natural gas in the world, was the other member of the Committee who favored the Association with some very practical thoughts along a different line of conservation, and his communication is also submitted in full, as follows:

"PITTSBURGH, PA., May the First, 1916.

"MR. I. C. WHITE, *Chairman,*
"Conservation Committee, N. G. A. of A.,
"Morgantown, W. Va.

"DEAR SIR: —

"The conservation of natural gas may be considered under two headings.

"First: Is the gas wasted by non-consumption or by useless burning after it has been developed, and Second: Do we procure all of the gas that it is possible to extract from the rocks, before abandoning the territory?

"It is a well known fact that, in times past, such a tremendous quantity of natural gas has been allowed to go to waste by escaping into the air or by burning, in order to heat all out doors, that those who are aware of the facts are ashamed when they think of past conditions. The stopping of this extravagance has only been accomplished by teaching people the value of what they have thrown away. The greater waste may now be said to be pretty well eliminated. The conservation laws of the western states are preventing the tremendous open flow at the oil pools and the new form of lease adopted by most of the companies in the East, where a certain number of cubic feet of gas is given free each year instead of an unlimited amount for domestic consumption, is doing away with the flambo and other such extravagances. There is, however, still a reckless consumption in the burning of gas. To prevent this, I see but one thing to do, which is to let the public realize its value. The easiest way to accomplish this is to charge the consumer what the gas is worth. At the price at which gas is sold in many places, there will be no conservation of it until the cheap supply is exhausted and the consumers will then regret the past and be obliged to pay twice what they might have been paying for their fuel supply.

"Many towns in the gas producing states have been boomed by advertising and selling gas at less than it actually cost the producer. This is the worst kind of fallacy not only for the town but for the manufacturers who accept the proposition.

"A number of states have Public Service Commissions which, in my opinion, can, or do only attend to one-half of their duty. The object of the commission seems to be fully accomplished when the consumer is protected from paying more than he thinks he should for gas; no attention seems to be paid to the general good of the community by preventing the sale of gas for less than it is worth.

"In delivering natural gas to consumers there are three main items of expense to be considered: FIRST — The discovery and development of the supply; this is more than the expense of drilling a well in a known gas field, for all the expense of prospecting for new territory and the rental upon leases so that tests can be made in the new districts, should be included. SECOND — The transportation from the point of development to the site of consumption. This should include interest charges and the depreciation of pipe lines, with the expense and cost of operation of pump stations. THIRD — The distribution throughout the consuming districts; which should include the interest and replacement expense with the operating expenses.

"If the Public Service Commissions would investigate the real cost of these separate items and would prevent the sale of gas below a fair price, the conservation of gas would be in a fair way of being accomplished.

"In considering the second phase of the subject, it is safe to say that, as a rule, we are not procuring all of the gas from an area before abandoning the territory. Here again comes in the question of price.

"When the rock pressure falls to fifty pounds, or less, the expense of keeping the well dry and in operating condition materially increases. With large virgin territory to be drilled, the companies cannot afford to produce from the small and expensive wells, and for this reason, many wells and areas are abandoned before they should be. In developing new territory the company that gets in first procures 'the cream.' In new sections many of the first wells drilled will make a volume of two or three billion cubic feet in their full life, while it is seldom that a well drilled in the third or fourth year of development, will make over six hundred million cubic feet of gas in its whole life.

"These facts make it very poor judgment for any company holding a part of the land in a new field to permit its competitors to extend their pipe lines without at once extending their own. This method of procedure causes the opening up of advance territory when the older districts are but partially drilled and nothing like exhausted.

"These few ideas upon the conservation of natural gas may be a little late in reaching you, but I was compelled to make a hurried trip to Oklahoma and only returned on Friday last.

"Very truly yours,
"W. T. GRISWOLD."

Mr. Griswold evidently had in mind mostly the West Virginia Public Service Commission when criticising the acts of State Commissions in matters affecting the price of natural gas. Some charity and patience, however, must always be had for the first inexperienced attempts of such Commissions to fix or regulate charges for any public necessity. Those of you who listened to the able address of Hon. Elliott Northcott, Chairman of the Public Service Commission of West Virginia, delivered before the West Virginia Natural Gas Association at its meeting in Charleston on April 27th last, must have been convinced of the broad, just and liberal views toward public utility corporations now held by that West Virginia official, and from the tone of the address in question, no one has any reason to fear that the suppliers of public utilities in West Virgnia have just cause for apprehension of unfair hearings or treatment.

The following letter received from another member of the Conservation Committee, Mr. E. L. Brundrett, President of the

Kansas City Gas Company, explains why he has not contributed to this discussion:

"KANSAS CITY, MO., April 6, 1916.

"MR. I. C. WHITE, *Chairman,*
Conservation Committee,
Natural Gas Association of America,
Morgantown, West Virginia.

"MY DEAR MR. WHITE: —

"I have just returned from Philadelphia, and find your letter of April 4 in reference to the meeting of the Conservation Committee of our Association.

"I regret to state that I am not able to make up the individual report which you suggest. I did not know I was on this Committee this year, and if I had known of this fact earlier I would have tried to persuade our worthy President to have put somebody on in place of me who is in closer touch with the field.

"You know, my business is distributing gas in the city of Kansas City, Missouri, only. We receive our gas from the pipe line company, and while there is an element of conservation in the use of gas among domestic consumers, still the greater waste of gas is in the fields and in the industries adjacent thereto.

"We have not sold any gas in Kansas City for purposes other than straight domestic purposes for the last two years.

"With kindest regards,

"Very truly yours,
"E. L. BRUNDRETT."

Nothing has been heard from Mr. Towl, the fifth member of the Committee.

Respectfully submitted,
I. C. WHITE,
Chairman.

DISCUSSION.

PROF. I. C. WHITE: Mr. President, amplifying the statement in the printed report that the great corporations controlling the development of these natural resources and the Legislature, which should have inaugurated efficient statutes for protection and conservation, can certainly not look back with pride upon the long chapter of inexcusable waste written into the natural gas history of these various states, I may add that I do not think there is an individual here who will not admit that in practically all instances this profligate waste of so valuable a natural resource is wholly inexcusable. Take, for instance, our own State of West Virginia, where the waste has been even greater than it was probably in Oklahoma, these great corporations, if they would unite next winter, or had they united in the past winters, they could have secured an adequate law and put it upon the statute books if they had so wished, protecting this natural product and requiring its conservation. Why they do not do it, Mr. Chairman, or why you, as President of one of these great corporations and all the other Presidents of these great corporations, do not make a fight for such a law I cannot understand. It is in your interest. It will serve you. There is no reason in the world why you should not have a law on the statute books of West Virginia, just like they have in Oklahoma whereas there is nothing there today except some old "chestnuts" that were passed years and years ago, simply regarding the plugging of wells. Nothing done to save the coal which will be needed for these gas lines after the gas is gone. They are destroying the coal of the richest coal fields in the world, that great Pittsburgh seam that extends from river to river, from the Mononghela to the Ohio, not a well being plugged except voluntarily. You know how that operates, very few will be plugged properly. Yet it could be done very cheaply and effectually. At the last session of our Legislature, I appeared at the call of the Governor to advocate a bill which had been introduced by Senator Gregory of Parkersburg, a bill which was the concensus of the natural gas men of the Appalachian District, the coal men meeting here in Pittsburgh with the Bureau of Mines all agreeing on the form of the bill, and yet when it was introduced it met with a very unwelcome reception, even by the men whom it would have benefited. I was called to Charleston to appear before the Legislature when that bill was before the Committee, and I could hardly get a hearing. The Chairman was against it. Finally I simply butted into the Committee room and found the members in session and forced them to listen to my story. But the bill never got out of the Committee. It was designed to plug properly these wells, to start some legal method of conservation. Of course some of the great companies do plug their wells properly and voluntarily, but there are many operators who do not do it, so that the result is that a great deal of oil and gas territory is being ruined by improper plugging or no plugging at all, and vast coal fields, more valuable than the oil and the gas fields, will probably be ruined irretrievably.

I say in the course of the report: "Whether or not the oil and gas interests of this state will ever permit the enactment of any proper legislation as in Oklahoma and California, to curtail the very large unnecessary waste which still continues, remains for the future to decide."

I use the word "permit" advisedly because if they would urge it they could get it but they have always opposed it, and as I have before said, why they do it I cannot understand. If this Natural Gas Association of West Virginia, which met only a few days ago, would go to Charleston at any session of the Legislature, they could get exactly what they ought to have and what they need, and there would be no trouble about that, but they oppose anything of that kind, I think practically against their own interests. Since the discovery of the mudding-in process by that great Bureau of the Government, about which Director Manning told us yesterday, it is the cheapest thing in the world to plug a gas well or an oil well. All you would have to do would be simply to pull the casing and put in some West Virginia or Pennsylvania mud, and there is plenty of it in both states. That would do it effectually. If you would screen out the rubbish and simply take the red clays, or the red pulverized shale, and make a mixture of it like they do in Oklahoma, you would not need to do anything else. Formerly, I suppose, you would have been required to fill the well with cement. That I think was one of the reasons why the bill introduced by Senator Gregory was found objectionable by so many operators. I do not think in the light of these discoveries of the Bureau of Mines that it would be necessary to use any cement, plain mud would be sufficient.

You will all probably remember the eloquent address given by the Congressman from Pittsburgh yesterday morning, wherein he spoke of signing some leases which Mr. J. M. Guffey had assigned to the Philadelphia Company. In that connection I will say that one of my earliest efforts in locating gas territory was for Mr. J. M. Guffey and the great well which he sold to the Philadelphia Company was located by myself on the Brown Farm at Browns Station on the Pennsylvania Railway. It was supposed to have a volume of thirty to thirty-five million cubic feet. It was lighted by W. S. Guffey for the benefit of President Cleveland when he came west on the Pennsylvania Limited one evening to visit Pittsburgh. The other parties had failed to shoot it off. The gas was so strong that the rockets which they shot into it horizontally did not set it off so that W. S. Guffey, being more practical and older in the business, got under the well and shot up through it and then it went off. It blazed 135 feet high. It was on the celebrated Murrysville Anti-clinal. Many of you know about the old Murrysville well that was drilled by accident at a point where the gas escaped through the crevices in the rock. Oil men in the earlier days where they saw gas bubbling up through the water inferred there might be an oil pool and they drilled the Murrysville well in search of oil but found instead one of the largest gas wells probably that was ever drilled in Pennsylvania. They did not know what to do with it. They were afraid to shut it in, or try to shut it in. It had a volume so enormous that they did not think it was possible to shut it in and some of you may remember that years later after it had blown into the air for probably a dozen years, the Philadelphia Company went to large expense and put down, I think, several tons of concrete to serve as an anchor to hold in this vast well. They had no idea what the rock pressure would be, and after they made sure that the casing would not come out of the well, by putting in vast quantities of concrete, the well was finally successfully closed, and the rock pressure found to be only five or six hundred pounds. Originally it was probably eight or nine hundred pounds so that your speaker, the same as Congressman Burke, was connected with the early history of the Philadelphia Company, that great corporation which supplies so much natural gas and which is now getting a great deal of it from my own state. I should say that Mr. Guffey is one of the few remaining Nestors of oil and gas business that believed in the anti-clinal theory which I had promulgated. I had leased up for him practically half of the West Virginia oil field. He had definitely within his grasp probably hundreds of millions in values but the Pittsburgh gentlemen who went in with him got "cold feet." He could not get any of the oil and gas people to believe in my theory. He got some politicians to put in some money, — Mr. Flynn, Bob Elliott, and people who had never been in the oil and gas business, but they soon got tired. They did not stay with him and he finally got afraid that the five hundred thousand acres of leases he had, covering all of the West Virginia oil fields down to the Little Kanawha River, would be more than he could carry and that they would hold him for the ten cents per acre annual rental which meant fifty thousand dollars a year. He surrendered them all at a cost of about six thousand dollars and just after that — only the next year, — the oil and gas history of West Virginia began.

With reference to the communication from Mr. W. T. Griswold, embodied in the report of the Committee, in my comment on this letter, I have assumed that Mr. Griswold, in criticizing public service commissions, had in mind especially the West Virginia Public Service Commission. I sent Mr. Griswold a copy of this report with my comments, and in a letter received from him since that time he states that he did not have West Virginia particularly in mind, but that he meant all the Public Service Commissions. You will all remember what happened to the Manufacturers Natural Gas Company of your city with the coming of the Public Service Commission in West Virginia into office. That great corporation made application for a permit to raise its rates. They asked for sugar, but the Public Service Commission handed them a lemon in the shape of a ***reduction*** instead of a ***rise***. They asked for bread and they gave them a stone. And the action of that Public Service Commission, as I recall now, was one of its first official acts. It was new in the business. It probably had not studied the question as deeply as it is possible to study it, but the main thing that guided them in that decision was the fact that gas was transported two hundred miles from its source of supply in West Virginia and sold at thirty cents in Cleveland, Ohio, for instance, and sold here in Pittsburgh, probably, for thirty cents, and in the state where the gas originated the Manufacturers Light and Heat Company were asking, I think, in some cases, twenty-five or even twenty-seven cents, and they thought that the difference was too great. Naturally they thought that the state which produced the gas ought to have a little benefit from it, and if that great corporation, or any corporation in West Virginia, after getting its gas there could transport it to Cleveland and sell it for thirty cents, it ought to be sold for about twenty cents in West Virginia. That would not look to be an unfair conclusion to any body of men who had never studied it, or to any body of men who are not expert. So that in commenting on Mr. Griswold's criticism, which I supposed, was mainly intended for the West Virginia Public Service Commission, I stated that the early work of any commission should be treated with a little charity and patience.

You will note in the letter from Mr. Brundrett he states that he did not know that he was on the Committee. How is that Mr. Jones?

SECRETARY JONES: He was notified, and he was there when the Committee was appointed.

PROF. I. C. WHITE: Then I guess he forgot it. With reference to the fifth member of the Committee, Mr. Towl, we got nothing from him. I do not even know whether he is in the country or not. Now, in conclusion, Mr. Chairman, I repeat my request to be relieved from the Chairmanship of this Committee, and I hope it will be your pleasure to appoint Mr. Diescher in my stead. I thank you. (Applause).

PRESIDENT CARTWRIGHT: I regret very much Dr. White's wish to retire from this Committee as Chairman. The least I think he can do would be to act as a member of the Committee. Would you be willing, Dr. White, to act as a member of the Committee, or in an advisory capacity?

PROF. I. C. WHITE: If I could be of any assistance I will assist in every way that I can consistent with the other demands upon my time.

PRESIDENT CARTWRIGHT: In that case I would be very happy indeed to appoint Mr. Diescher as Chairman of the Committee, if he will accept the position.

Just a word of explanation or apology for the attitude of the West Virginia gas companies on this very great question of conservation. The natural gas companies would very gladly join with the public officials of West Virginia and of other states in the real conservation of gas, but the attitude of the Legislatures and the attitude of many of the public officials of a great many of the states has been such that public utility companies have been so much on the defensive to keep from having their properties confiscated that they have not had very much time to do anything else except to conserve their property and protect their rights as against adverse legislation, but I think there is a better time coming, and I am quite sure the West Virginia Natural Gas Association will be very glad indeed at some early date to join with your splendid organization in getting through proper legislation looking to real conservation. At the same time I think it must be very gratifying to you, Dr. White, to witness the marked improvement there has been along these lines without legislation in West Virginia. I know I can recall in my experience — and it has covered comparatively few years, as compared with yours, there has been a decided change for the better, and much of it has been due — indeed practically all of it has been due — to the pioneer work that you have done, and the constant and insistent demand from you and from like scientists for direct conservation and for the correction of this frightful waste, and I think today our West Virginia fields probably have as little waste as any of the Eastern gas fields.

PROF. I. C. WHITE: All got too much (applause).

MR. J. C. MCDOWELL: Mr. Chairman, there are many of us who would like to speak on this very interesting subject that has been so excellently placed before us, by Dr. White, but the hour is late. If we get started on it I am afraid we would not know when to quit. Consequently I move you that a vote of thanks be tendered to Dr. White for his very excellent report on this vital subject.

PROF. I. C. WHITE: And also the other members of the Committee, Mr. Chairman, who have contributed certain portions of the report outside of my own.

Mr. J. C. McDowell: And also to the other members of the Committee. I move that a vote of thanks be tendered to Dr. White for the work that he has done in this behalf and also to the other members of the Committee.

Mr. John M. Garard: I take great pleasure in seconding the motion.

The above motion having been duly seconded was then unanimously adopted.

President Cartwright: I might say that this report is printed under separate cover and all members who desire a copy of it may secure them from Mr. Jones, our Secretary.

Prof. I. C. White: I will say, Mr. Chairman, that there are several clerical errors occurring in the report, as printed, but I will not take the time now to call attention to the specific instances.

President Cartwright: If you will call the errors to the attention of the Secretary he no doubt will see that they are corrected.

Gentlemen, the afternoon is rapidly drawing to a close, and we will have to hurry the program through to some extent as we have several papers, and other matters to attend to, according to the regular order of business. The next paper is upon the subject, "Measurement of High Pressure Gas," by Mr. Schell.

Mr. W. F. Schell then read the following paper:

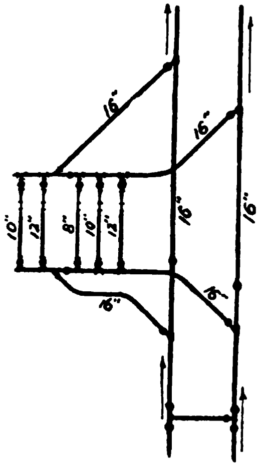
MEASUREMENT OF HIGH PRESSURE GAS.

W. F. Schell.

Although the title assigned to this paper is a comprehensive one, the paper itself will deal only with one part of the problem, and will be limited to a description of some tests of large capacity meters at high pressures.

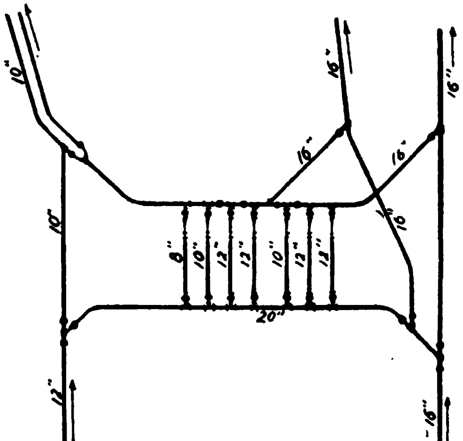
In July, 1914, The Pittsburgh and West Virginia Gas Company installed at the state line between Pennsylvania and West Virginia, measuring stations to measure the gas sold to the Equitable Gas Company. The most important of these stations are at Littleton and Blacksville, W. Va.

The gas is measured at the Littleton and Blacksville stations by Venturi Gas Meters, there being five installed at Littleton and seven at Blacksville. The meter tubes are connected to inlet and outlet headers, as shown in the sketches (Figures 1 and 2). The tubes have each a valve on the inlet and one on the outlet, and the headers are divided by valves in such a manner that the



VENTURI MEASURING STATION
OF THE PITTSBURGH & WEST VIRGINIA GAS CO.
LITTLETON, W. VA.

FIG. 1.



VENTURI MEASURING STATION
OF THE PITTSBURGH & WEST VIRGINIA GAS CO.
BLACKSVILLE W. VA.

FIG. 2.

various lines leaving the station may be measured independently if desired. Each tube is connected to a recorder located in a nearby building. These recorders are operated by iron floats in mercury wells, and are in essence recording differential gauges. They are calibrated for one set of conditions of temperature pressure and specific gravity of the gas. The hourly rate of flow, based upon these conditions, is recorded upon a chart, and by means of a counter, driven by a clock movement, the total cubic feet measured in any period of time is obtained. Proper corrections are made in determining the cubic feet measured when the actual conditions of temperature, pressure and specific gravity differ from those for which the meter is graduated.

This type of measuring device had been frequently tested at low pressures, as described by Professor Thomas in his paper "The Measurement of Gases," in the Journal of the Franklin Institute for November, 1911, and in the Report of the Committee on the Measurement of Gas in Large Volumes in the Proceedings of the American Gas Institute for 1914, and had been found reliable and accurate. In addition to these, the following tests which we made with a 4" x 2" Venturi Meter throw some light upon the subject.

TEST WITH AIR.

4" x 2" VENTURI METER.
4" YOUNG PROPORTIONAL METER.
FLOWOMETER.

Inlet Press. Inches of Water.	Correct. Volume Venturi M. Cu. Ft. Per Hr.	Correct. Volume Pro. Met. M. Cu. Ft. Per Hr.	Correct. Volume Flowomet. M. Cu. Ft. Per Hr.	% Variation Venturi Flowometer.	% Variation Venturi Prop. Meter.	% Variation Proport. Meter Flowometer.	Temp. Fahr.	Barometer.
5.5	2880	3010	2980	—3.4	—4.3	1.0	70	28.7
5.6	3960	3950	3960	O. K.	0.3	—0.8	70	28.7
5.7	4810	4960	4960	—3.0	—3.0	O. K.	70	28.7
5.8	6000	5920	5960	0.7	1.3	—0.7	70	28.7
5.8	7930	7900	7940	—0.1	0.4	—0.5	70	28.7
6.0	10100	10100	10150	—0.5	O. K.	—0.5	70	28.7
6.5	12600	12400	12400	1.4	1.6	—0.2	70	28.7
6.7	15000	14700	15000	O. K.	2.0	—2.0	70	28.7
8.0	20000	19300	19900	0.5	3.6	—3.0	70	28.7
Average Variation				0.012	1.3	—1.25		

TEST WITH NATURAL GAS.

4" x 2" Venturi Meter.

2 No. 100 Westinghouse Meters.

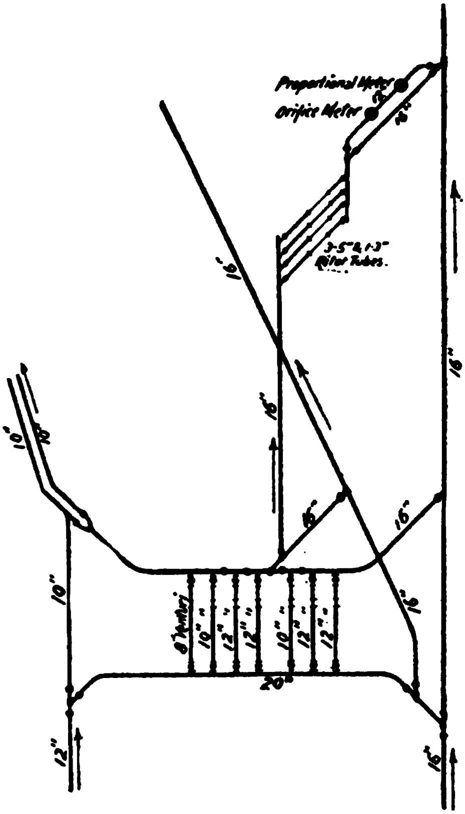
Inlet Pressure, Inches of Water.	Corrected Volume, Venturi Meters, M. Cu. Ft. Per Hour.	Corrected Volume, West. Meters, M. Cu. Ft. Per Hour.	Per Cent Variation, Venturi, Westinghouse.	Temperature.	Specific Gravity.
12	4,900	5,040	—2.8	60	.664
12	7,130	7,040	1.3	60	.664
12	9,500	9,750	—2.6	61	.664
12	11,250	11,400	—1.3	61	.664
12	13,100	13,000	0.7	62	.664
13	14,400	14,650	—1.7	62	.664
12	16,250	16,120	0.8	63	.664
12	18,900	19,500	—3.1	64	.664
	Average	Variation	—1.1		

However, there was no information obtainable concerning the use of Venturi Meters with the high pressures and large volumes encountered in Natural Gas practice; so a series of tests was planned to determine the reliability and comparative accuracy of this type of meter under such conditions. The Blacksville measuring station of the Pittsburgh and West Virginia Gas Company was chosen as the most convenient place for the tests.

As a positive test was impossible because of the large volumes to be handled, it seemed desirable to employ as many inferential methods of measurement as possible. The arrangement shown in Figure No. 3 was finally decided upon.

The apparatus used consisted of one 12" x 6", one 10" x 3" and one 12" x 5" Venturi Meter; three 5" and one 3" Calibrated Pitot Tubes, one 12" Orifice Meter, and one 12" Proportional Meter.

The Pitot Tubes used are similar to those described by Mr. T. R. Weymouth in his paper "Measurement of Natural Gas," read before the American Society of Mechanical Engineers, and also described by Mr. B. C. Oliphant in his report to this Asso-



ARRANGEMENT OF METERS
COMPARATIVE TESTS,
BLACKSVILLE, W. VA.
August, 1915.

FIG. 3

ciation in 1912. These Pitot Tubes consists of 12 ft. of seamless drawn brass tubing, highly polished on the inside, with the tip mounted at the center. The ones used in these tests had been calibrated against standard Pitot Tubes which were themselves calibrated against a gas holder.

The Orifice Meter used is one of a type that has been on the market for several years. It consists of a plate ⅛" thick, in which is a 6" orifice with flat sides. Pressures connections are made close to the plate on each side, and the differential and static pressures recorded by recording gauges. The static pressure connection is taken from the low side of the orifice.

The Proportional Meter had been overhauled and carefully tested just prior to its use in these tests. Where it was found to differ from the standard flowometer used in testing it, proper corrections have been made in computing the corrected volumes measured by it. The maximum deviation in the shop test of this meter was from 1% fast to 1.3% slow.

It was planned originally to include an electric meter in these tests, but this was found to be impracticable, as there was no meter of a suitable range available at the time. It would have been a desirable check upon the accuracy of the velocity meters tested to have included an electric meter, as it depends upon a different principle for its accuracy. However, there have been many careful and successful tests made with electric meters in conjunction with both Pitot Tubes and Orifice Meters, notably those described by Professor Thomas in his paper "The Measurement of Gases," Journal of Franklin Institute 1911, and Mr. J. C. Wilson in his paper "The Measurement of Gas in Large Volumes," read before this Association in 1914. A very close agreement was found between the electric meter and the Pitot Tubes and Orifice Meters, so it seemed safe to assume that a comparison of the Venturi Meter with those types of flowometers is equivalent to a direct test against the electric meter.

Primarily, these tests were planned to check the accuracy of the Venturi Meters, but also the performance of the various commercial types of large capacity meters used in these tests was considered.

The gas passed first through one Venturi Meter Tube and through the other meters in turn. When the volume to be measured became greater than the capacity of the Orifice and Proportional Meters as in Tests No. 1, these meters were by-passed.

Tests Nos. 1-5, inclusive, were made under operating conditions; readings were taken hourly from the integrating counters of the Venturi recorders, the recording differential and static pressure charts of the Orifice Meter, the pressure chart and counter of the Proportional Meter. The Pitot Tubes were fitted with spring gauges to indicate the static pressure, and water pot gauges to indicate the differential pressure. Readings were taken on these every fifteen minutes during the tests.

The average pressure at the inlet of the Venturi Tube was obtained from recording pressure gauges connected to the inlet header.

Test No. 6 was made for the purpose of checking a Venturi Meter throughout its range. The rate of flow was regulated by manipulating a by-pass gate. Each rate was held constant a sufficient length of time to obtain the necessary readings.

Tests Nos. 7 and 8 were each of fifteen hours duration. All readings were taken from the recording charts.

A thermometer placed in the inlet header gave the flowing temperature of the gas. Samples of the gas were taken at frequent intervals from the inlet header. These were analyzed, and tested for specific gravity by means of a Schilling Apparatus.

The flowing temperature and specific gravity of the gas were found to be quite constant during the period of the tests.

A typical analysis of the gas is as follows:

CH_4	79.4
C_2H_6	19.4
CO_2	0.0
O_2	0.0
N_2	1.2
	100.0

The results of the tests are shown in the following tables. All volumes are corrected to a pressure and temperature base of 10 oz. above atmosphere and 62° Fahrenheit.

COMPARATIVE TEST
of
No. 1 VENTURI METER, SIZE 12" x 6".
5" x 3" STANDARD PITOT TUBES.
Blacksville, W. Va., August 21, 1915.

Time.	Average Pressure, Venturi.	Average Stat. Pressure, Pitot.	Average Flowing Temp. F.	Average Specific Gravity.	Corrected Volume, Venturi M. Cu. Ft.	Corrected Volume, Pitot M. Cu. Ft.	Per cent Variation, Vent. Pit.
9:45	154	154	68	660	1,271	1,252	1.5
10.45	153	151	68	660	1,296	1,258	3.5
11:45	149	148	68	660	1,316	1,286	2.3
12:45	146	145	68	660	1,295	1,267	2.2
1:45	148	148	68	660	1,004	1,000	0.4
2:45	146	147	68	660	639	632	1.1
3:45	146	146	68	660	595	595	0.4
4:45	140	141	68	660	472	470	0.4
Total	....	....	....	....	7,888	7,760	1.6

COMPARATIVE TEST

of

12" x 6" VENTURI METER.

3" AND 5" STANDARD PITOT TUBES

12" ORIFICE METER WITH 6" ORIFICE.

12" WILEY PROPORTIONAL METER.

Blacksville, W. Va., August 24, 1915.

Time.	Average Pressure Venturi.	Avg. Stat, Pressure Pitot.	Avg. Stat. Pressure Orifice.	Average Pressure Pro. Meter.	Average Flowing Temp. F.	Average Specific Gravity.	Correct. Volume Venturi M. Cu. Ft.	Correct. Volume Pitot M. Cu. Ft.	Correct. Volume Orifice M. Cu. Ft.	Correct. Volume Pro. Met. M. Cu. Feet.	% Var. Venturi Pitot.	% Var. Venturi Orifice.	% Var. Venturi Pro. Met.	% Var Pitot Orifice.	% Var Pitot Pro. Met.	% Var. Orif. Pro. Met.
9:45	148	147	....	....	67	.656	716	723	....	....	—1.0	....	....	....	....	....
10:45	141	140	....	....	67	.656	683	682	....	....	0.1	....	....	....	....	....
11:45	136	136	133	136	67	.656	647	657	669	660	—1.5	—3.3	—2.0	—1.8	—0.6	1.4
12:45	134	134	132	134	67	.656	684	682	687	684	0.3	—0.5	O. K.	—0.8	—0.3	0.5
1:45	131	131	128	131	67	.656	663	653	660	680	1.5	0.5	—2.5	—1.1	—4.0	—2.9
2:45	128	128	125	128	67	.656	653	649	658	666	0.6	—0.8	—1.9	—1.4	—2.6	—1.2
3:45	125	124	122	124	67	.656	647	630	642	657	2.7	0.8	—1.5	—1.9	—4.1	—2.3
4:45	122	122	120	123	67	.656	641	625	642	661	2.5	—0.2	—3.0	—2.6	—5.4	—2.9
Total 6 hours....................................							8,885	8,846	8,908	8,958	1.0	—0.6	—1.8	—1.6	—2.8	—1.3
Total 8 hours....................................							5,284	5,251	....	....	0.6	....	....	....	....	....

COMPARATIVE TEST
of
12" x 6" Venturi Meter.
10" x 3" Venturi Meter.
5" Standard Pitot Tubes.
12" Orifice Meter with 6" Orifice.
12" Wiley Proportional Meter.
Blacksville, W. Va., August 25, 1915.

Time.	Average Pressure Venturi.	Avg. Stat. Pressure Pitot.	Avg. Stat. Pressure Orifice.	Average Pressure Pro. Meter.	Average Flowing Temp. F.	Average Specific Gravity.	Correct. Volume Venturi M. Cu. Ft.	Correct. Volume Pitot M. Cu. Ft.	Correct. Volume Orifice M. Cu. Ft.	Correct. Volume Pro. Met. M. Cu. Feet.	% Var. Venturi Pitot.	% Var. Venturi Orifice.	% Var. Venturi Pro. Met.	% Var Pitot Orifice.	% Var Pitot Pro. Met.	% Var. Orif. Pro. Met.
9:45	140	140	135	138	67	.654	836	822	829	837	1.7	0.8	—0.1	—0.9	—1.8	—1.0
10:45	133	133	130	130	67	.654	759	747	755	746	1.6	0.5	1.7	—1.1	0.1	1.2
11:45	128	128	125	128	67	.654	654	649	658	646	0.8	—0.6	1.2	—1.4	0.5	1.9
12:45	124	123	120	123	67	.654	650	638	647	645	1.9	0.5	0.8	—1.4	—1.1	0.3
1:45	121	120	117	120	67	.654	646	633	641	642	2.1	0.8	0.6	1.2	—1.4	- 0.2
2:45	119	118	115	118	67	.654	641	627	635	636	2.2	0.9	0.8	—1.3	—1.4	—0.2
3:45	116	116	113	116	67	.654	634	620	629	625	2.3	0.8	1.4	—1.4	—0.8	0.6
4:45	114	114	110	113	67	.654	628	615	622	616	2.1	—1.0	1.9	1.1	—0.2	1.0
Total							5,448	5,351	5,416	5,393	1.8	0.6	1.0	—1.2	—0.8	0.4

COMPARATIVE TEST
of
12" x 6" VENTURI METER.
3" AND 5" STANDARD PITOT TUBES
Blacksville, W. Va., August 26, 1915.

Time.	Average Pressure Venturi.	Avg. Stat. Pressure Pitot.	Average Flowing Temp. F.	Average Specific Gravity.	Corrected Volume Venturi M. Cu. Feet.	Corrected Volume Pitot M. Cu. Ft.	% Variation Venturi Pitot.
9:45	129	126	67	.655	1,047	1,030	1.6
10:45	121	119	67	.655	735	722	1.8
11:45	118	116	67	.655	726	707	2.7
12:45	115	114	67	.655	718	701	2.4
1:45	114	113	67	.655	645	645	O. K.
2:45	112	111	67	.655	513	529	—3.0
Total					4,384	4,334	1.2

COMPARATIVE TEST
of
12" x 6" Venturi Meter.
5" Standard Pitot Tubes.
12" Orifice Meter with 6" Orifice.
12" Wiley Proportional Meter.
August 27, 1915.

Time.	Average Pressure Venturi.	Avg. Stat, Pressure Pitot.	Avg. Stat. Pressure Orifice.	Average Pressure Pro. Meter.	Average Flowing Temp. F.	Average Specific Gravity.	Correct. Volume Venturi M. Cu. Ft.	Correct. Volume Pitot M. Cu. Ft.	Correct. Volume Orifice M. Cu. Ft.	Correct. Volume Pro. Met. M. Cu. Feet.	% Var. Venturi Pitot.	% Var. Venturi Orifice.	% Var. Venturi Pro. Met.	% Var Pitot Orifice.	% Var Pitot Pro. Met.	% Var. Orif. Pro. Met.
8:45	127	126	125	127	66	.655	520	517	513	502	0.6	1.4	3.6	0.8	3.0	2.1
9:45	125	124	121	124	66	.655	615	611	623	630	0.7	—1.3	—2.4	—1.9	—3.0	—1.1
10:45	121	120	117	120	66	.655	542	530	554	562	2.3	—2.2	—3.6	—4.3	—5.7	—1.4
11:45	116	116	114	116	66	.655	555	554	553	557	0.2	0.4	—0.4	0.2	—0.5	—0.7
12:45	113	112	110	112	66	.655	533	510	535	533	4.5	—0.4	O. K.	—4.7	—4.3	0.4
1:45	111	110	108	110	66	.655	540	518	539	532	4.2	0.2	1.5	—3.9	—2.6	1.3
Total							3,305	3,240	3,317	3,316	2.0	—0.4	—0.3	—2.3	—2.3	0.03

COMPARATIVE TEST

of

10" x 3" VENTURI METER.

5" STANDARD PITOT TUBES.

12" ORIFICE METER WITH 6" ORIFICE.

August 26, 1916.

Test No.	Average Pressure Venturi.	Avg. Stat. Pressure Pitot.	Avg. Stat. Pressure Orifice.	Average Flowing Temp. F.	Average Specific Gravity.	Correct. Volume Venturi M. Cu. Ft.	Correct. Volume Pitot M. Cu. Ft.	Correct. Volume Orifice M. Cu. Ft.	% Variation Venturi Pitot.	% Variation Venturi Orifice.	% Variation Pitot Orifice.	% of Total Capacity Venturi.
1	110	110	107	67	.655	110	105	142*	4.7	—22.0	—26.0	16.0
2	109	109	106	67	.655	224	219	222	2.3	0.9	—1.3	33.0
3	109	109	106	67	.655	289	277	284	4.3	1.8	—2.5	43.0
4	111	111	108	67	.655	326	325	332	0.3	—1.8	—2.1	48.0
5	109	109	105	67	.655	401	388	396	3.4	1.3	—2.0	59.0
6	108	108	105	67	.655	483	481	484	0.4	—0.2	—0.6	72.0
7	112	112	109	67	.655	506	498	502	2.6	0.8	—1.8	74.0
8	108	107	104	67	.655	514	500	512	2.8	0.4	—2.4	77.0
9	108	107	104	67	.655	581	564	582	3.0	—0.2	—3.1	87.0
10	108	107	104	67	.655	617	613	623	0.7	—1.0	—1.6	92.0
Average Variation Tests 2-10									2.1	0.2	2.0	

* Below the accurate range of Orifice Meter.

COMPARATIVE TEST
of
10" x 3" VENTURI METER.
12" ORIFICE METER WITH 6" ORIFICE.
12" WILEY PROPORTIONAL METER.
15 Hours Duration.

Date.	Pres. Venturi Average.	Sta. Pr. Orifice Average.	Pres. P. M. Average.	Average Flowing Temp. F.	Average Specific Gravity.	Corrected Volume Venturi M. Cu. Ft.	Corrected Volume Orifice M. Cu. Ft.	Corrected Volume Pro. Meter M. Cu. Ft.	% Variation Venturi Orifice Meter.	% Variation Venturi Pro. Meter.	% Variation Orifice Pro. Meter.
Aug. 26-27	118	116	117	66	.655	7,107	7,100	7,026	0.1	1.1	1.1
Aug. 27-28	125	118	122	66	.655	5,799	5,786	5,909	0.2	—1.9	—2.1

The results of the hourly tests Nos. 1-5, are summarized in the following table:

Venturi Pitot.			Venturi Orifice.			Venturi Pro Meter.		
Max. Hourly % Variation.		Ave. % Var.	Max. Hourly % Variation.		Ave. % Var.	Max. Hourly % Variation.		Ave. % Var.
+	—		+	—		+	—	
4.5	3.0	1.4	0.9	3.3	—0.02	3.6	3.6	—0.2

Pitot. Orifice.			Pitot. Pro Meter.			Orifice. Pro Meter.		
Max. Hourly % Variation.		Ave. % Var.	Max. Hourly % Variation.		Ave. % Var.	Max. Hourly % Variation.		Ave. % Var.
+	—		+	—		+	—	
1.2	4.3	—1.6	3.0	5.7	—1.8	2.1	2.9	—0.3

It will be noticed that the maximum hourly variation in the case of each pair of meters varies from fast to slow, due probably to experimental error. The average variation for each pair of meters, for the five tests, is also given in the table and shows a close agreement in measurement between the four types of meters tested.

It seems safe to say that under the proper conditions and with reasonable care, each of these four types of meters will give results which check within 2%.

Certain features of each type were brought out in the tests.

The characteristics of the Pitot Tube and Proportional Meters are well known, and will not be discussed.

The ratio of the differential pressure to the pressure loss through the Venturi Meter Tube is approximately 8 to 1; with an orifice this ratio is approximately 1.4 to 1. This greater differential for the same loss of pressure through the meter makes possible a more positive recording device for use with a Venturi Tube than with an orifice. This fact makes the Venturi Meter particularly applicable to permanent measuring stations such as are described in this paper.

However, where the quantity of gas to be measured is likely to vary over a considerable range, such as during the life of a well, or cannot be predetermined with sufficient accuracy to fix the size of Venturi Tube required, the disadvantage of the pressure loss through the orifice is offset by its greater flexibility; that is, it is a much simpler mattet to change an orifice than a Venturi tube.

In my opinion, both types can be used to advantage in a measuring system; but the important point, in this connection, is the need for complete and reliable measurement throughout the system.

Discussion.

President Cartwright: Mr. Weymouth, will you kindly review the paper a little bit and start the discussion? I will ask you that you do not take too much time. While we would like to have more time to spend on it, yet the evening is getting pretty well advanced.

Mr. Thomas R. Weymouth: Mr. President; I have no very extensive comment to make upon it. In fact, I have nothing but words of praise for the completeness and thoroughness with which Mr. Schell has handled the subject. The paper furnishes some very valuable data on the subject of measurement of high pressure gas, and indicates the advance that has been made on this subject, and the improvements in measuring apparatus in recent years.

There is one paragraph in the paper I would like to comment on, however, and that is the fifth paragraph on the last page where the pressure loss is noted through the Venturi meter tube. It seems to me a misconception is liable to arise in the statement that "the ratio of the differential pressure to the pressure loss through the Venturi meter tube is approximately eight to one; with an orifice this ratio is approximately 1.4 to 1." If you will refer to the table of tests giving the comparison of various meters, it will be seen that the recovery of the pressure between the Pitot tube and the proportional meter is complete in many cases. This is probably due to the inability to read the guages with sufficient accuracy to know what slight drop there might be. You will note, however, that the orifice pressure is lower. The orifice is connected between the Pitot tube and the proportional meter so that these tests would indicate a recovery of pressure, and I know that to be the fact. The ratio of 1.1 to 1 is simply an apparent ratio. It gives the ratio of loss of pressure at that point instead of the loss of pressure at the point farther down the line. That would affect the statement likewise in the next paragraph. The paper is a very excellent one, I think, and one that we can all read and study with a great deal of profit.

President Cartwright: Any other remarks on the paper?

Mr. Edward D. Leland: Mr. Schell's experiment has shown very excellent results in the development of the orifice principle in measuring the flow of gas. These developments have been very satisfactory indeed. One of our members, Mr. Hildebrand, had more or less experience with this orifice principle some years ago, and I think it would be well to get the results of those earlier experiments and have them presented to us and embodied in the proceedings.

President Cartwright: At the suggestion of Mr. Leland I will now call upon Mr. Hildebrand.

Mr. H. D. Hildebrand: Inasmuch as the exact measurement of gas flowing into the line is dear to the hearts of every gas man for financial as well as scientific reasons and because the throttle disk or orifice meter is looming up as one of the most accurate means of such measurement, I desire to submit to the Society information as to what I believe to be the first tests ever made in this country for measuring the flow of gas by this method. At least, it is the first and only test so far as I know where it has been used in conjunction with the indicator on the compressor to determine the volumetric efficiency of a compressor.

Important studies on the subject of the measurement of gas by means of Pitot tubes, orifices, etc., were made as far back as 1911 or 1912 and first presented by Mr. Weymouth before the American Society of Mechanical Engineers. Also, there has been presented an article on the same subject by Mr. Rouse in 1914 before the American Society of Mechanical Engineers and also by Mr. Wilson before this same society on the same subject of electric meter measurement of gas and only last year a medal was awarded to Mr. Hickstein by the American Society for an article on the flow of air through plate orifices.

In Kansas City, in 1912, Professor P. F. Walker delivered a speech on the efficiency of gas compressors using the indicator card as a means of volumetric measurement, the calculation being based on the discharge line instead of, as formerly, on the suction line of the card. In closing his speech, he said: "The writer is of the opinion that the gas compressor in regularly operating plants, with the volumetric efficiency carefully determined by the method outlined above, may be made to serve the purpose of meters to check line flow calculations by established formulæ."

You will please note that none of the above articles appeared before 1912.

In 1908 or 1909 the Hope Engineering & Supply Company constructed a gas compressing station for the Granby Mining &

Smelting Company at Neeodosha, Kansas, in which was installed a compressor of the Hall make driven by a gas engine. In the final acceptance test for this plant, a dispute arose as to the accuracy of proportional meters to measure the exact capacity of these machines. At this time, I was employed as engineer for the Hall Steam Pump Company and submitted to them a plan for using the indicator to measure the volumetric efficiency, using the discharge line of the card as a medium for such measurement. Our President, desiring to have another opinion on this subject, consulted Mr. W. Trinks, Professor of Mechanical Engineering at the Carnegie Technical Schools, as to his opinion of whether or not this was a good and accurate method of measuring air compressor capacity. At first blush, and without previous thought, Professor Trinks said that he thought that it was of very little consequence, but that the most accurate method of measurement was that recently made and tested out at Charlottenburgh, the throttle disk being used as a medium. He had in his possession at that time the data regarding these tests as he was teaching it as a regular course in the schools. He had also constructed throttle disks for the measurement of steam and had applied them in some instances with considerable success. To test out the card method of measurement, it was decided to make test on the regular apparatus of the Technical Schools and the test was conducted in the latter part of June, 1909, by Professor Trinks and myself with the assistance of a few students, the Professor taking charge of the throttle disk method and I taking care of the indicator method. When the test was finally consummated and all the calculations made, it was found that there was very little variation in the results obtained.

As a result of this test, I am pleased to read a letter written to the Hall Steam Pump Company by Professor Trinks, dated July 7th, 1909. I wish to state before reading this letter that, in making the test, the possibility of error was eliminated by finding the exact loss in the compressors through leakage by preliminary tests for such loss. The letter follows:

"I have compared by test your method of determining the volumetric efficiency of an air compressor from the indicator card, with that of using a throttle disc. This latter method is, next to the use of a positive displacement meter, the most reliable manner of determining the rate of flow of any fluid. Your method of measuring the capacity of a compressor on the discharge line of the indicator card and then correcting the temperature and pressure, agrees very closely with the results obtained from the throttle disc, provided that proper precautions are observed when the measurements are made. It is understood that indicators, guages and thermometers must be calibrated so as to show correctly.

"With correctly calibrated instruments there exist only two sources of error which might make the efficiency as determined from the card too high; one being leaky discharge valves and the other too low a temperature measurement of the discharged air.

"With proper care both errors can easily be eliminated. The tightness of the discharge valves can be ascertained by trial before the test; for instance, by opening the indicator cocks, while pressure is on the discharge line.

"The temperature of the discharged gas or air must be measured immediately after leaving the discharge valves, that is, before it has had a chance to cool perceptibly. In order to obtain the true temperature of the discharge the thermometer bulb must be exposed to the hot current close to the discharge valves. It must not be enclosed in a thermometer well or cup, but should pass through a rubber stopper, which in turn is tied fast to the discharge pipe, or, still better, to the discharge chamber of the compressor cylinder.

"When these precautions are observed, the results obtained with your method of measuring cards can vary only a few per cent from the true valve. "Yours truly,

"W. TRINKS,

"Professor of Mechanical Engineering, Carnegie Technical Schools."

The result of these tests and the method of measurement was made known to Mr. F. P. Fisher, at that time connected with the Philadelphia Company and, without consulting him, I believe he will agree that this was the first intimation he had of this method of measuring gas and it was after this test that he started on his experiments both at the Tri-County Gas Company and the Quapaw Gas Company, the results of which he has so ably produced in his article read before the American Society of Mechanical Engineers last month at New Orleans.

MR. W. F. SCHELL: The ratio of the differential pressure to the pressure loss through the orifice meter, of which Mr. Weymouth spoke, was obtained from a special test made to determine this point. A mercury column was connected differentially between the inlet side of the orifice plate and a point about six feet from the plate on the outlet side. Readings were taken simultaneously of the differential as shown by the recording gauge and the pressure drop as shown by the mercury guage. These readings gave the ratio of 1.4 to 1 referred to.

Mr. Geo. W. Barnes: Mr. President, I move you that we tender a vote of thanks to Mr. Schell for his very able paper, and to the gentlemen who have so intelligently and instructively discussed it. I know we are all very much interested in the subject and Mr. Schell has given us some very valuable information.

The above motion, having been duly seconded, was then unanimously adopted.

President Cartwright: Gentlemen, there will be just one more report received before we adjourn for the evening, but before calling upon Mr. Weyer, the Chair desires to call your attention to the fact that tomorrow morning the most important paper of the meeting is to be read. The engineers of the Bureau of Mines, along with an engineer of one of the larger operating companies in Ohio, proposes to point out to you natural gas men how you are going to get something for nothing in the form of the recovery of gasoline from natural gas. We ought to have an overflow meeting tomorrow morning. The attendance has been very good today, but not as good as it should have been. The heads of the different companies should get after their men and see to it that they each and all attend these meetings. We are only going to have one session tomorrow, which will start promptly at ten o'clock. We are not going to recess during that session. We may have to lock the doors — I don't know, but we are not going to stop until we are through. Therefore I want to enjoin on all members to be present here promptly in the morning at ten o'clock. This gasoline question is a question which concerns every one of you. All of you either own cars or hope to own cars and many of your companies own cars, so that you have all been concerned on the buying side and now I know you will be concerned on the selling side when I tell you that you are about to get something for nothing. Something for nothing comes very seldom in the average gas man's life, so we want you all here.

If. Mr. Wyer is present we will now be glad to have that very interesting report of his read on the subject: "Report from the Association's Representatives to the Gas Safety Code Conference, United States Bureau of Standards."

Mr. Samuel S. Wyer then said: Mr. President and Gentlemen; The hour is too late to read the report of the work done by the Gas Safety Code Conference, United States Bureau of Standards in the preparation of the proposed national gas safety code. You will find the report on pages 50 and 51 of the printed papers and reports of this meeting now before you.

I will close by stating that when the Code is completed it will be built along sound engineering lines and when it is promulgated by the United States Bureau of Standards, as the standard code, not only as far as the company's end is concerned, but also as far as the public's end is concerned, it will be something that the gas interests need not be afraid of, but will be of substantial service to them. I thank you.

Mr. Samuel S. Wyer then submitted, without reading, the following:

REPORT ON NATIONAL GAS SAFETY CODE.

COLUMBUS, OHIO, April 8, 1916.

To the Natural Gas Association of America: —

As your representative on the Advisory Engineering Committee that is advising with the United States Bureau of Standards, Washington, D. C., in the preparation of a National Gas Safety Code, I submit the following as a summary of the year's work:

The Bureau of Standards is planning to develop a code for the entire gas industry, both natural and manufactured, along lines similar to those pursued by the Bureau in the development of its recent National Electric Code. This gas safety code is to be divided into 10 parts, as follows:

1. Manufacture;
2. Distribution;
3. Appliance Design;
4. Gas Fitting;
5. Appliance Installation;
6. Natural Gas Wells and Field Stations;
7. Acetylene;
8. Gasoline Gas and Bottled Gas Systems (Pintsch, Blau, and Casing-head Gasoline.)
9. Blast-furnace and Producer Gas;
10. Utilization — Information for Users.

In order that this Code should represent every possible viewpoint of safety, the Bureau invited a number of Associations to appoint representatives to advise with them in the preparation of the Code, the institutions so invited, and their representatives, being as follows:

1. American Gas Institute, J. B. Klumpp, W. J. Serrill.
2. National Commercial Gas Assoc., O. H. Fogg, W. W. Barnes.
3. Natural Gas Association, S. S. Wyer.
4. National Fire Protection Assn., C. A. Hexamer, F. J. T. Stewart.
5. American Inst. of Architects, D. E. Waid, Julius Franke.
6. National Safety Council, H. W. Forester, J. M. Morehead.
7. Public Health Service, Dr. J. W. Schereschewsky.
8. Nat'l. Assoc. of Master Plumbers, T. P. McLaughlin.

A large amount of statistical information has been gathered, several conferences have been held, and Part 4 is practically completed. The Code is being built along correct engineering and sound business lines, and natural gas companies need have no fear that it will be injurious to their interests.

The Code will be available in typewritten form for inspection and discussion before it is finally acted upon or promulgated by the U. S. Bureau of Standards, so an ample opportunity will be presented for all interested parties to be heard and their interests considered.

SAMUEL S. WYER.

Mr. John M. Garard: Mr. President, I move that we tender a vote of thanks to Mr. Wyer for his report which no doubt has been read by every member here present owing to the importance of the subject, and the distinguished character of the man presenting it, and also tender him a vote of thanks at this time particularly for the shortness of his discussion with reference to it.

Mr. George W. Barnes: I take great pleasure in seconding the motion.

The above motion, having been duly seconded, was then unanimously adopted.

And thereupon, on motion duly seconded and carried, the meeting adjourned until Thursday, May 18th, 1916, at ten o'clock A. M.

THIRD DAY — MORNING SESSION.

Friday, May 18, 1916.

President Cartwright: Gentlemen, the meeting will please come to order. The first order of business upon the regular program is the report of the Committee on Awards for the Wrinkle Department, of which Mr. F. W. Stone is chairman. We will now hear Mr. Stone's report.

Mr. F. W. Stone then submitted the following:

REPORT OF COMMITTEE ON AWARDS FOR THE WRINKLE DEPARTMENT.

Mr. Chairman and Gentlemen of the Convention:

There are so many wrinkles which have been submitted that the Committee on Awards have been utterly unable to wade through the material furnished and arrive at a decision. We have spent a great deal of time and thought in our effort to be able to report at this session of the Association. However, we do not want to do any one an injustice and there has been so much valuable material submitted that we feel it ought to be very carefully considered. Therefore we would ask for further time and for permission to render a written report to the Secretary, say within the next two or three weeks. There are approximately 150 wrinkles and it is altogether out of the question to read and consider them in the limited amount of time at our disposal since we first got together. The wrinkles were not submitted to us until we arrived at the convention, and we feel that we ought to have a little further time granted us to consider them.

PRESIDENT CARTWRIGHT: It seems to me, gentlemen, that the request of the committee ought to receive the approval of the Association.

MR. JOHN MCMILLEN: If a motion to that effect is necessary, I would make the motion that the committee on awards be granted the time as requested.

MR. KAY C. KRICK: I second the motion.

The above motion, having been duly seconded, was then unanimously adopted.

PRESIDENT CARTWRIGHT: I want to call the attention of the members again to the fact that the wrinkles submitted are to be published under separate cover and the different companies can secure them for 25 cents a copy for distribution among their men, by applying to our Secretary, Mr. Jones.

MR. F. W. STONE: May I ask whether the wrinkles submitted in previous years are to form a part of the book that is to be prepared and published?

PRESIDENT CARTWRIGHT: Well, that was not our thought at the present, but probably at some future time that may be taken care of. I might suggest if the heads of the companies do not make application for these wrinkles, we will probably ship them to the different companies and bill them anyway. Therefore you might as well ask for them now because we do not expect to keep them and we expect to get pay for them.

The next order of business upon the regular program will be a paper by Mr. Robinson, Secretary of the West Virginia Natural Gas Association, on the subject, "Rules for Natural Gas Service."

Mr. Edwin Robinson then read the following paper:

RULES FOR NATURAL GAS SERVICE.

Edwin Robinson

Rules for Natural Gas Service may be divided into two classes. Those adopted by Public Service Commissions for the government of Utilities in the conduct of their business with the Public and those adopted by Gas Utilities governing the sale of gas to Consumers.

Rules and regulations adopted by Public Service Commissions governing Gas utilities are frequently of a very drastic nature which require considerable work in having them modified so that utilities may be able to operate under them.

One reason, Rules and Regulations Commissions adopt require modification is the acceptance of rules of the Bureau of Standards as applicable for all gas service.

The Bureau of Standards has many rules of merit governing gas service, but these rules are not all applicable to *Natural* Gas Service.

Commissions for States in which natural gas is sold have realized that changes must be made in the rules originally adopted.

In preparing this paper I have confined myself to West Virginia where both classes of rules have been adopted within the past year.

In adopting rules and regulations the Public Service Commission of West Virginia followed other commissions in using Bureau of Standards Rules for Gas Service as a guide, and some of them were of such character that it was necessary to ask to have them modified.

The West Virginia Natural Gas Association had just been organized and immediately appeared before the commission asking for a hearing on suggested changes of certain rules, which was granted. Representatives of the association had several conferences with the commission and at the commission's suggestion a committee from the association and the chief engineer of the Public Service Commission were directed to work out the suggested changes and submit them to the commission for consideration.

Many of the Utilities in West Virginia had been conducting business in such manner that some of the new rules adopted only carried out a custom which had grown out of better service.

Rules requiring Utilities to maintain its entire plant in such condition so as to enable it to furnish safe, proper and adequate service; the making of annual systematic inspection of plants; plants to be in accordance with best modern practice; information to consumers as to reading of meters; records of complaints as to service; furnishing meters and service connections; care to prevent waste; the "Safety First" policy, were practiced by most Utilities before the Rules were adopted.

It was found, however, that Rules requiring limited pressure and pressure gauges should apply only to low pressure plants when sufficient consumers are supplied to justify the additional expense. It was decided that this rule should apply to low pressure plants of not less than fifty consumers.

It was also decided that the Rule requiring request tests should apply only to meters on low pressure plants. The expense of testing meters on high pressure consumers at their request, even if limited to one test in twelve months, would cost the Utility more than the consumer's gas bills for a year. These consumers may be located ten or more miles from a meter proving shop; the cost of hauling the meter to the shop, returning it to the consumer necessitated this class of meters to come under the Rule for complaint tests which requires the consumer to make formal written application to the Public Service Commission for a test which is made by an inspector of the commission.

The charges fixed by the commission for making such tests are as follows:

1,000 cu. ft. per hour and under	$1 50
Over 1,000 to 10,000	4 00
Over 10,000 to 40,000	6 75
Over 40,000 to 70,000	9 25
Over 70,000 to 100,000	12 00

For meters having a capacity greater than 100,000 cubic feet per hour, and for orifice and other meters, the commission establishes a suitable fee upon application.

Gas Service on high pressure lines is accommodation service. It is neither desired nor profitable. Circumstances are such that it must be taken care of, for land owners along the high pressure lines are usually friends of the company.

In furnishing this service special Rules are necessary, for the consumer must assume risks incident to the use of the gas from high pressure lines and the care and liability of appliances necessary in the use and control of same. Rules and regulations governing this service will be discussed later.

The Commission's Rule that no gas except such as is used in street lights of mantle type and drilling and repairing of isolated wells shall be sold or furnished without charge except by metered service is certainly a good Rule for every line spells *Conservation.*

Some difficulty has been experienced in the enforcement of this rule. Considerable opposition from free gas consumers in some sections of the State in having their gas metered has delayed its general enforcement. But this opposition is being gradually overcome.

The expense of furnishing and setting the meters for free consumers was accepted by the Utilities in the belief that the saving of gas would justify the cost when the reading of the meter was furnished the consumer and if too excessive, the Commission.

The Commission's Rule requiring "any consumer desiring service discontinued shall give five days notice to the Utility thereof" is to protect the property of the Utility from destruction where consumers hurry a competing Company selling cheap gas to make connections without regard to other peoples' property.

The Rule requiring accuracy of meters is certainly beneficial to the Utilities for some of them were very negligent in the past in allowing meters to remain in service that should have been in the scrap-heap.

Each Utility must file with the Commission its Rates and Rules and Regulations which are part of the Application for Gas Contracts consumers sign, and also to post them in its offices including a copy of the Law governing Public Service Utilities together with copy of Rules and Regulations adopted by the Commission so that the Public may inform itself on these matters.

The Rules and Regulations of the Public Service Commission of West Virginia governing Natural Gas Utilities now in force are fair and equitable and the Utilities are making every effort to comply with them and it is seldom that we hear of any complaint.

In dealing with the Commission we only suggested changes in its Rules that did not apply to Natural Gas Service or that we could not comply with without such additional expense that the service would be unprofitable.

In dealing with a Public Service Commission it is necessary to have its confidence. Insisting that all Commission Rules are unsatisfactory and unjust in the hope of a compromise giving more than is really wanted soon drives what confidence the Commission has into suspicion that all matters brought before it must be closely investigated and any statement by Representatives of Utilities must be verified.

We now come to the Rules and Regulations adopted by Natural Gas Utilities governing the sale of gas to Domestic and High Pressure Consumers, which usually appear on Application Contracts which the consumer must sign when applying for gas.

As the West Virginia Commission requires each Utility to file a copy of its Rules and Regulations and each Utility having its own Rules and Regulations differing in some way from every other Utility and some not having any, the Commission directed the West Virginia Natural Gas Association to draft Rules and Regulations for the Utilities to adopt subject to the Commission's approval.

The Committee in charge of this work secured copies of Rules and Regulations from all the Utilities and it was only necessary to satisfy each Utility (which thought its Rules were the best) and the approval of the Commission to make its work a success.

The adoption of these Rules and Regulations by Utilities and the Public Service Commission having approved them make them a little out of the ordinary and I have been requested to embody them in this paper.

RULES AND REGULATIONS FOR DISTRIBUTION AND SALE OF NATURAL GAS.

(Approved by the Commission, October 14, 1915.)

1. The Gas Company will furnish and install the following appliances and piping which remain its property, viz.: The pipe between its gas main and the consumer's property line, a street connection stop cock and curb box, and a meter. The street connection stop cock will be installed at a convenient place between the property line and the curb, and that portion of the piping from main to street connection stop cock shall be known as the Gas Company's street connection.

2. The Consumer hereby undertakes to furnish and lay the necessary pipe to make the connection from the consumer's

property line to the place of consumption and to keep the service line from the street connection stop cock to the place of consumption in good repair, but the Gas Company shall pay the expense of any repairs to that portion of the service line between the street connection stop cock and the property line, but the consumer otherwise shall not make change in or interfere with said service line without the written consent of the Gas Company. The character and arrangement of the service line shall be subject to the approval of the Gas Company but the Gas Company shall not be responsible for or have any duty or obligation with respect to the same. In the installation of a service line the consumer must not install any tees or branch connections and must leave the trench open and pipe uncovered until it is exhibited to the Gas Company's inspector free from such irregularities.

3. The consumer shall use all due care to prevent waste of gas. The responsibility of detection of defects and leaks on the consumer's premises and in the service line is upon the consumer and in case of failure or deficiency of gas, irregular supply, leakage, excessive pressure and other developments incident to handling gas under pressure, the consumer agrees to give immediate notice thereof to the Gas Company, and his failure to do so, should loss follow, shall be negligence.

4. The authorized agent of the Gas Company shall at all reasonable times have free access to the premises of the consumer, with the right to shut off the gas and remove its property from the premises for any of the following reasons:

First:	For repair.
Second:	For non-payment of any bill due under this or any previous contract.
Third:	For fraudulent tampering with the meter or piping on the premises.
Fourth:	Removal of the consumer from the premises.
Fifth:	For selling or delivering gas to other occupants of the premises without the written permission of the Gas Co.

Sixth: For failure to make or increase an advance payment or deposit on the lawful demand of the Gas Company.

Seventh: Upon permanent exhaustion of the supply.

Eighth: For leakage or waste of gas from consumer's piping.

Ninth: For failure to comply with these Rules and Regulations or for the violation of any of them.

5. The Gas Company may, as provided by law, require a deposit or guarantee or advance payment, or such an increase in such deposit or guarantee or advance payment for gas to be supplied, and may apply such deposits to bills previously incurred by the consumer under this or previous contracts with the Gas Company.

6. The Gas Company does not guarantee or undertake to furnish a sufficient supply of gas at all times and shall not be liable for failure so to do, beyond its available supply; nor shall it be liable for any injury to person or property from any cause arising inside the street connection stop cock not the result of the negligence of the Gas Company; nor shall it be liable for any injury to person or property arising from the use of gas by, or the supply of gas to, the consumer which is not the result of negligence on the part of the gas Company.

7. This contract is not transferable.

Consumers must make application in person at the office of the Gas Company at the time they commence the use of gas, or they will be held responsible for the back charges against the premises.

8. Whenever gas shall be turned off or meter disconnected by reason of non-compliance with the Gas Company's rules, an extra charge of one dollar ($1.00) must be paid at the Gas Office before the gas shall be turned on again.

9. In case an execution shall be issued against the consumer or in case the consumer's premises or the personal property upon said premises shall be levied upon, under attachment or execution, or in case of assignment or other acts of insolvency of the con-

sumer, the Gas Company may terminate the contract and all claims for gas previously delivered shall become forthwith due and payable.

10. No discount for prompt payment of bills shall be allowed unless all previous just bills have been paid in full and the current bill is paid within the discount period specified on the bill.

11. The Rules and Regulations of the Gas Company are subject to addition and changes by the Company and such additions and changes become a part of any contract between the Gas Company and a consumer if lawful under the rules of the Public Service Commission of West Virginia or the laws governing said Commission.

ADDITIONAL RULES FOR CONSUMERS ON HIGH PRESSURE MAIN AND FIELD LINES, NOT ON LOW PRESSURE SYSTEMS.

(Approved by the Commission, December 4, 1915.)

RULE NO. 12.

The place of delivery of the gas is at the tap on the Company's pipe line. The consumer has knowledge that the gas pressure in the Company's pipe line varies from time to time, even to the extent of the sudden and entire failure of gas, and the subsequent return of the supply at uncertain hours of the day and night, and that in the regular operation of its lines for the delivery of gas to cities and towns where low pressure systems are maintained, the Gas Company cannot give notice to scattered consumers in the country districts of these changes in supply and pressure. The consumer hereby assumes the duty of regulating the flow and pressure of gas into his service line by appliances thereon, and by the necessary labor, care and supervision of the same, so that he may safely conduct said gas over his premises, and safely distribute and use it. The consumer undertakes to shut off all fires when there is no one at the residence to look after them, and assumes the responsibility of attending to his gas-burning and pressure-regulating appliances at all times and under all conditions; the consumer also assumes all risks from variations in pressure caused by the use and operation of compressors; from defects in pipe connections and appliances; from the escape and leakage of gas; from the sticking of valves and regulators, and from any and all causes incident to the handling and burning of gas on said premises, and hereby waives notice of all changes of pressure and supply.

RULE NO. 13.

The consumer will furnish and install the necessary service line to transport the gas from the Company's main to the point of consumption, and in order to secure safe and adequate service, will furnish the necessary regulators and safety appliances, required to reduce the pressure from the maximum pressure on the Company's main to eight (8) ounces. The type and number of said regulators and safety appliances, and their installation, to be subject to the approval of the Gas Company before gas will be turned into the consumer's pipes. The information necessary to determine the number of regulators and safety appliances required, will be furnished to the consumer by the Company upon application. The Company will tap its main, provide and install a nipple and stop cock to turn on and shut off the gas from the consumer's service line.

The regulator or regulators, will be installed by the consumer at the tap on the Company's line, and a safety blow-off valve, or a fluid seal, will be installed by the consumer at the outlet of the meter, so adjusted as to operate and relieve any pressure on the consumer's line over sixteen (16) ounces. The Company will furnish the regulators and appliances required, and install same at the expense of the consumer, if he so desires.

The meter furnished by the Company will be attached to the consumer's service line at the outlet of the low pressure regulator. Around the regulator or regulators, and the meter, the consumer will provide and install a substantial covering to properly protect them from the weather, and from being interfered with by irresponsible parties. Said covering to be furnished and maintained by the consumer, but the Company, by its proper representative, shall have access to the meter and regulator at all times for the purpose of reading the meter, and making such inspections as it reasonably can, to ascertain if the meter, regulator and appliances are in proper working condition.

The consumer shall not interfere with said regulators or meters, except to see that they are kept in proper working order; neither will he increase the pressure on same without the written approval of the Gas Company, and such interference, will be sufficient cause for the discontinuance of service. If, for any reason, additional pressure is necessary, arrangement for the same must be made with the Company.

RULE NO. 14.

The line from which the gas is supplied by the Company is not intended and cannot be maintained solely for service to scattered consumers in country districts, and the Company may, at its own discretion, cease to furnish gas, either temporarily or permanently, change, repair or remove its pipe line or change the use of it, without prejudice to the right of the Company to continue its supply to other consumers. In case of cancellation of this contract 30 days' written notice shall be given by the one cancelling to the other party. The Company shall not be liable for any deficiency in the supply caused by the use of compressing stations, breakage of lines, or other causes, or for any claim for damages on account of anything done under the provisions of this paragraph.

RULE NO. 15.

Where gas is furnished for drilling and pumping wells, and uses other than domestic consumption, the applicant agrees to use such gas under this contract, as his exclusive fuel on said premises for said purposes until this contract is terminated; and agrees to provide and install such regulators and appliances as may be necessary to control the pressure, and use the gas with safety and economy, as provided in Rule 13.

RULE NO. 16.

The Company may at its option, read the meter quarterly instead of monthly, and require the consumer to make sufficient deposit, or give adequate guarantee as security, for that period;

payment for gas in such case, shall be due within ten days after date of bill rendered, which date of payment will be approximately the 10th day of the month following the end of the quarter year.

The Natural Gas Utilities of West Virginia now have uniform Rules and Regulations, approved by the Public Service Commission, regulating the sale of gas to their consumers which is an advanced step in the right direction.

In conclusion I wish to say, our work before the Commission and its Chief Engineer was pleasant and agreeable and the Rulings of the Commission were fair and just.

DISCUSSION:

PRESIDENT CARTWRIGHT: Gentlemen, the paper is doubly interesting, due to the fact that Mr. Robinson is Secretary of the West Virginia Gas Association, and has had much to do with the promulgation of these rules. I am sure he would be glad to answer any questions concerning this subject which any member of the Association might desire to ask him. Mr. McMillen, I would like to have you comment on these rules, as you have had a very wide experience in the distribution of gas and rules for natural gas service.

MR. JOHN MCMILLEN: Mr. President, I think Mr. Robinson has covered the subject very fully. There is one thing, however, I did not quite understand, and that is with reference to the ownership of the line between the service cock and the consumer's premises. According to his understanding, I would like to inquire who has supervision over it. As I understand it, the company has supervision over it.

MR. EDWIN ROBINSON: No, the commission insisted that the utilities should lay the line from its main to the consumer's premises and on account of a ruling of a former commission and also a court ruling in a water case in West Virginia, we had them to agree to this rule that we lay the service to the property line and put the stop cock between the property line and the curb at some convenient place, and the consumer assumes all risk from the stop cock to his point of consumption. He is supposed to keep it in repair, but we pay the expense of the repair between the stop cock and the property line. We tried in every way to get the commission to agree to have our responsibility cease at the curb, but in view of the fact of the ruling of the former commission and the court ruling referred to, we compromised on the rule that we now have.

MR. JOHN MCMILLEN: As I understand then, the responsibility to the public utility ceases at the stop cock?

MR. EDWIN ROBINSON: I believe the court would uphold now that our responsibility ceases at the stop cock, our contention being that we had no liability beyond the stop cock, although we agreed to put the service line into the property.

PRESIDENT CARTWRIGHT: Any further remarks, on this paper? I may say before closing the discussion on this paper that one of the large companies with which I am associated in West Virginia was very much surprised to find the amount of gas that our free consumers were using. Personally, I was not very keen about the introduction of meters on free gas to certain consumers. I felt that they were utilizing the gas in a fairly economical manner, but Mr. McCloy of the Philadelphia Company, and Mr. Sullivan of the Manufacturers Light & Heat Company were rather keen to have this rule incorporated among those approved by the Commission. We found in the companies with which I was associated that 150,000 feet per month was not unusual for the free gas consumer. In fact, we have found consumers using as high as 250,000 feet per month and anything under 100,000 feet looks rather small. I recall one instance down in Lincoln County where a man had a three or four room house and his January bill was 278,000 feet. I think almost any gas man will find that the practice of free use of gas has been abused by almost every free consumer. The Public Utilities Commission, however, is getting after these consumers very energetically and through them we hope to cut them down to an economical point, furnishing them only a reasonable amount of gas. We believe that 150,000 feet should be the limit for the free gas consumer.

MR. JOHN M. GARARD: Mr. President, I move you that a vote of thanks be tendered to Mr. Robinson for his very able paper.

The above motion, having been duly seconded, was then unanimously adopted.

PRESIDENT CARTWRIGHT: The next regular order of business will be the report of the Joint National Committee on Electrolysis, of which Mr. Wyer is a member.

MR. SAMUEL S. WYER: Mr. President and Members of the Natural Gas Association, the report of the Joint National Committee on Electrolysis is found on pages 48 and 49 of the printed bulletin. I will not take time now to read it. It is before you where all of you can peruse it at your leisure and study it thoroughly. All I desire to say now is that the report is now in galley proof form in the hands of a sub-committee of the joint committee of 21 and will within a few weeks be ready for distribution. When it does come out in its first form it will not contain any specific recommendations, for the reason that the first report, the committee thought, should be used primarily for educational purposes. That is, to educate not only the street railway men but also the pipe owning company officials as well. Later on a final report will be issued which will contain specific recommendations with regard to the best remedial measures to install in order to get the necessary relief. No definite arrangements have yet been made for the distribution of the report. The committee will have several hundred copies printed and whatever arrangements are made by the officers of the Natural Gas Association of America, will of course be satisfactory to the committee as a whole. It will, however, be up to this Association to make such arrangements as it may see fit for the distribution of the report, which will be ready for distribution in the very near future.

Mr. Samuel S. Wyer, on behalf of the committee, then submitted the following:

REPORT OF JOINT NATIONAL COMMITTEE ON ELECTROLYSIS.

To the Natural Gas Association of America:

Your committee appointed to represent the Association in the Joint National Committee on Electrolysis reports the following as a summary of the year's work:

The work during the past year has been in the immediate charge of the Publication sub-committee, the personnel of this being as follows:

E. B. Katte, Chairman, American Railway Engineering Association.

A. S. Richey, American Electric Railway Association.
F. N. Waterman, American Institute of Electrical Engineers.
P. Torchio, National Electric Light Association.
A. F. Ganz, American Gas Institute.
S. S. Wyer, Natural Gas Association of America.
H. S. Warren, American Telephone and Telegraph Co.
E. B. Rosa, National Bureau of Standards.

This sub-committee has gone over the various sections of the report in an editorial capacity, and after having numerous conferences and spending a great deal of time in consultation, have agreed on the subject matter, and a contract has just recently been let for the printing of the report. However, before the report is given to the public it will be gone over once more, in galley form, by the Publication sub-committee, and then by the Committee as a whole. After the entire Committee has passed on the proofs the report will be made public.

An enormous amount of information has been gathered by the Committee, and this report when published, will be by far the most comprehensive discussion that had ever been prepared. Furthermore, the report as a whole has been built up along sound engineering lines, and ought to be of great value to pipe owning companies in future electrolysis controversies.

Respectfully submitted,
FORREST M. TOWL,
Chairman.
B. C. OLIPHANT,
SAMUEL S. WYER.

PRESIDENT CARTWRIGHT: Gentlemen, you have heard the report of this committee. The Chair will be glad to entertain a motion to receive and place on file this report and also to continue the present committee.

MR. F. W. STONE: Mr. President, I move that the report of the committee be received and placed on file and that the committee be continued.

The above motion, having been duly seconded, was then unanimously adopted.

PRESIDENT CARTWRIGHT: We will now have that very important paper by Mr. George A. Burrell, Mr. P. McDonald Biddison and Mr. George G. Oberfell on the

EXTRACTION OF GASOLINE FROM NATURAL GAS BY ABSORPTION METHODS.

George A. Burrell.
P. McDonald Biddison.
George G. Oberfell.

This paper deals with a method of extracting gasoline from natural gas by absorbing the gasoline in oil and subsequently separating the gasoline from the oil by distillation. The process is quite different from compression and condensation methods that have been used for a number of years for extracting gasoline from casing-head natural gas and has not heretofore been described in the literature.

The extraction of gasoline from casing-head natural gas by compression and condensation methods has assumed the proportions in this country of a large and lucrative industry and placed in the market in the year of 1914 about 43,000,000[1] gallons of gasoline. In addition there was used in marketing this casing-head gasoline at many plants an equivalent quantity of naphtha with which the casing-head gasoline was blended, thereby utilizing for automobile fuel and other purposes a very large quantity of naphtha that otherwise would have been unsuited for these purposes. A depression in the price of gasoline part of that year kept the production down to a certain extent. The increase for the year 1914 over 1913 was about 18,000,000 gallons. For the year 1915 the production should be well in excess of 75,000,000 gallons and in 1916 well over 100,000,000 gallons. The quantity of casing-head natural gas treated in the year 1914 by compression and condensation methods amounted to about 17,000,000,000 cubic feet. The average yield of gasoline was 2.43 gallons per 1000 cubic feet. This casing-head natural gas represents gas that formerly went largely to waste, hence the process represented a distinct and important step in the conservation of the natural resources of this country.

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[1] Mineral resources of the United States. U. S. Geological Survey. part 2. page 800. 1914. J. D. Northrop.

A description of the methods employed in the manufacture of casing-head gasoline and a discussion of the tests to determine whether sufficient gasoline is present in a given type of natural gas to warrant the installation of an extracting plant is contained in Bulletin No. 88 of the Bureau of Mines.[2]

By the compression and condensation method of treating natural gas, only casing-head natural gases, or so called "wet" gases could be treated, and in order to make the operation profitable natural gases that contain less than three-fourths of a gallon of gasoline per 1,000 cubic feet are usually not utilized. Hence there has been exempted not only a large amount of casing-head natural gas, probably more than one-half the available supply, but also the enormous and much larger amount of so called "dry" natural gas that is used in cities and other places for domestic, factory, and other uses. The quantity of this kind of natural gas consumed in 1914 amounted to 591,000,000,000[3] cubic feet.

By absorption methods much of the so called "dry" natural gas can be treated. The method consists essentially in bringing the natural gas in contact with some kind of a heavier oil than gasoline, or in using a low grade naphtha, and letting the absorbents absorb the gasoline from the natural gas and either separating the extracted gasoline from the oil by distillation, or if a naphtha is used, say about 50° Beaume specific gravity, simply letting this naphtha absorb as much of the natural gas gasoline as it will, thereby increasing the volume and also producing a blend that is intermediate in specific gravity between natural gas gasoline and the naphtha used as an absorbent.

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[2] Burrell, G. A. Seibert, F. M., and Oberfell, G. G. The condensation of gasoline from natural gas, Bulletin 88, Bureau of Mines.

[3] Loc. cit., page 753.

PRODUCTION OF NATURAL GAS IN 1913 AND 1914.

The following table gives the production and value of natural gas for the year 1913 and 1914:[4]

Quantity and Value of Natural Gas Produced in the United States in 1913 and 1914, by States.

State.	Quantity (M cubic feet).	Cents per M cubic feet.	Value.	Quantity (M cubic feet).	Cents per M cubic feet.	Value.
	1913			1914		
West Virginia	245,458,985	13.92	$34,164,850	238,740,162	14.87	$35,515,329
Pennsylvania	118,860,269	18.25	21,695,845	108,494,887	18.80	20,401,295
Ohio	50,612,211	20.79	10,521,980	68,270,174	21.48	14,667,790
Oklahoma	75,017,668	9.91	7,436,889	78,167,414	10.30	8,050,089
Kansas	22,884,547	14.37	3,288,394	22,627,507	14.76	3,340,025
New York	8,515,257	28.50	2,425,638	8,935,187	29.10	2,600,852
Louisiana Alabama	26,652,626	7.95	2,119,948	26,774,695	8.32	2,227,999
Texas	12,159,755	17.05	2,073,823	18,488,639	13.36	2,469,770
California	11,084,597	17.07	1,888,450	17,528,928	16.88	2,910,784
Indiana	2,920,614	28.52	843,047	2,579,675	29.28	755,407
Illinois	4,767,128	12.04	574,015	3,547,841	12.32	437,275
Kentucky	1,821,526	27.99	509,846	1,421,818	34.52	490,875
Arkansas Colorado Wyoming	1,106,374	24.36	269,421	962,998	22.23	214,108
South Dakota North Dakota	66,492	46.87	31,166	60,781	44.78	27,220
Missouri	20,865	32.57	6,795	18,085	29.41	5,319
Michigan	1,805	77.84	1,405	2,042	70.61	1,442
Tennessee	2,400	25.00	600	1,200	25.00	300
Iowa	120	100.00	120	200	100.00	200

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[4] Northrup, John D. The Production of Natural Gas in 1914. Mineral resources of the United States. 1914. Part 2, page 751, U. S. Geological Survey.

The foregoing table shows a production of 591,866,733,000 cubic feet of natural gas for the year 1914, an increase of about 10,000,000,000 over year 1913.

All of this gas will not be available for the absorption of gasoline from it but the largest portion of it will be available. Almost all of the natural gas in the United States contains higher members of the paraffin series of hydrocarbons than methane. The ordinary combustion analyses of natural gas only show the two predominating paraffin hydrocarbons, usually methane and ethane.[5] The authors have never tested a natural gas that showed methane and ethane, that did not contain in addition the higher members of the paraffin series of hydrocarbons when an additional test was made for these constituents. The latter comprise propane, butanes, pentanes, hexanes, etc. The latter two comprise most of the gasoline that is obtained by the absorption method. These so-called "ethane" gases predominate among the natural gases of the country, undoubtedly to the extent of more than 500,000,000,000 cubic feet used per year. For instance, all the natural gas used in Pittsburgh, Buffalo, Columbus, Cincinnati, Cleveland, Louisville and hundreds of other towns contains ethane.[6] The same is true of natural gas produced in Oklahoma, Kansas, California, Texas and other states. Some natural gases that contain methane as the only paraffin hydrocarbon are found in Louisiana, in the Caddo Fields, at a few places in Oklahoma, in the Murrysville sand, Pennsylvania and at a few other places. These methane gases are the only ones that do not carry gasoline vapors. It may happen in a new well, where the pressure is very high, that not enough of the gasoline is carried by the natural gas to warrant the installation of a plant to extract gasoline by the absorption process, but the most of the natural gas produced in this country undoubtedly can be treated at the present time. If one assumes that one pint of gasoline can be obtained per 1,000 cubic feet of gas, there will be extracted 500,000,000 pints of gasoline from 500,000,000,000 cubic feet of gas or about 60,000,000 gallons of gasoline per year. If one assumes two pints per 1,000 cubic feet then the total becomes 120,000,000 gallons per year. Probably 75,000,000 gallons would be a conservative estimate that can be obtained by treating the natural gas in this country at the present time. In the case of some of the so-called "dry" natural gas that the author tested, three pints of gasoline per 1,000 cubic feet were obtained. If one assumes that gasoline has a value of $0.20 per gallon, then the total value of the gasoline becomes $15,000,000 per year. At $0.25 per gallon the sum becomes about $19,000,000 per year. This is about twenty per cent of the total value of the natural gas used in 1914 and probably 7½ per cent of the total quantity of gasoline consumed in 1914.

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[5] Burrell, G. A. and Seibert, F. M., The Sampling and Examination of Mine and Natural Gases. Bulletin 42, Bureau of Mines.

[6] Burrell, G. A. and Oberfell, G. G. The composition of the Natural Gas used in 25 cities in the United States. Technical Paper 119, Bureau of Mines.

CONSUMPTION OF GASOLINE.

During the year 1909 the quantity of gasoline consumed amounted to about 11,000,000 barrels. In 1914 the amount consumed had increased to 18,000,000 barrels, and it is estimated that the consumption in 1916 will be about 38,000,000 barrels of 42 gallons each or about 1,600,000,000 gallons.

CONDENSATION OF GASOLINE IN PIPE LINE.

Gasoline condensing in trunk lines is a constant source of annoyance and expense, because of its action on the rubber rings used in the patent pipe couplings, which are now universally used on all large pipe lines in place of the old style socket and thread "collars."

It softens and decomposes the rubbers until they weaken and give way causing a "blow out," that is, the pipe line will part, causing the gas to escape into the air.

Repairing "blow outs" at all hours of the night is a large item of expense, besides the amount of gas lost in that manner is very great. The expense and annoyance frequently attached to the breaking of a gas line and escape of gas is shown by the recent experience of one of the large natural gas companies.

A report was received at the main office that the pressure on a certain line was falling at the rate of 30 pounds per square inch per hour, although the compression station reported everything normal there. This condition indicated a break in the line and men were immediately dispatched to patrol the line, and locate the difficulty, which was found about midnight. Twenty-six men were used the balance of the night and the next day in order to repair the line. During this time the pressure had to be raised 70 pounds at the compressing station, and the factory service on the line discontinued.

One company informed the authors that the cost of rubber for couplings used in the pipe lines that transported 100,000,000,000 cubic feet in 10 years through an 18-inch pipe line for a distance of 35 miles was $16,000. This was for the rubber alone and did not include the cost of placing the couplings or other expense.

Thus it would seem that a method for removing gasoline from natural gas, thereby preventing the solvent effect of the gasoline on rubber pipe line couplings becomes valuable for the latter reason, in addition to the fact that a valuable fuel is recovered for sale. The process is one of great conservation of our natural resources.

THE DEVELOPMENT OF THE GENERAL PROCESS OF PASSING NATURAL GASES THROUGH OILS OR NAPHTHA FOR THE EXTRACTION OF GASOLINE.

As in the case of the casing head gasoline process, the absorption process of extracting gasoline from natural gas has assumed industrial importance as the demand for gasoline increased. The idea follows closely the process of extracting benzole, toluol, and other vapors (light oil) from gases made by destructively distilling coal. In this process the gases are caused to flow at about atmospheric pressure counter current to a stream of wash oil, a petroleum distillate as so called "straw" oil or "mineral seal" oil or a coal tar distillate such as creosote oil. Absorbing towers in which this is accomplished are 50 to 75 feet high and about 10 to 15 feet in diameter. After the benzole and toluol have been scrubbed from the gas, the charged oil is sent to steam stills where the benzole and toluol are extracted. The process is continuous in that the absorbent oil is used over and over again. The process has been used for many years in Germany and to a very large extent during 1915 and 1916 in the United States. Many types of absorbers and steam stills and different conditions of temperature and pressure were employed before a standard procedure was evolved. The difference between the process of extracting gasoline from natural gas and extracting benzole and toluol from coke oven gases is that with the natural gas, the absorption is conducted at high pressure. This is an economic necessity because the natural gas at present being treated by the absorption process exists at this high pressure, and cannot be profitably treated any other way. The transportation system must not be disturbed.

There might also be mentioned a process in vogue for a number of years past, and practiced at some refineries, of subjecting uncondensed gas and petroleum vapors from stills to absorption in naphtha, thereby increasing the gasoline yield considerably. Also a scheme sometimes practiced of passing natural gas through crude oil in tanks, and later compressing and cooling the natural gas to obtain the gasoline extracted from the oil.

English patent No. 30,229, issued to Albrecht von Groeling of Vienna, Austria, December 24, 1909, covers a process for "Improvements in or Relating to the Utilization of Natural Gases or Petroleum Distillation Gases." The claims follow:

(1). A process for the utilization of natural gases or of petroleum distillation gases, consisting in treating the gases at an adjustably increased pressure and adjustably reduced temperature, by quantities determined beforehand, of an absorption medium, for instance of heavy benzine, the unabsorbed gases being then condensed by the use of high pressure and low temperature.

(2). An apparatus for use in carrying out the process set forth in Claim 1, in which the gas is treated, in a series of absorption apparatus arranged one behind another, at an adjustably varying increased pressure and adjustably varying reduced temperature, with the absorption medium, so that said absorption medium can circulate through the various absorbers, and the heat absorbed during the expansion of the compressed gases is withdrawn directly from the absorption medium for the purpose of cooling the latter.

(3). A process of the kind set forth in Claim 1, in which gases utilized are first washed at an ordinary temperature and normal pressure with "heavy benzine".

(4). A process of the kind set forth in Claim 1, in which the natural gases escaping from a bore-hole, or petroleum distillation gases are first heavily compressed, then cooled and finally washed, in the state of exceedingly fine division, with cooled liquid benzine or the like, for the purpose of separating portions of the gas that can be condensed, both the cooling of the benzine required for the washing, and the cooling of the gas utilized after the compression, being effected with the expanding gases escaping from the absorption column, the gas being finally condensed by the use of high pressure and low temperature.

(5). An apparatus for use in carrying out the process set forth in Claim 1, or 4, comprising a column several meters high filled with benzine or the like, into the bottom portion of which the compressed cooled natural gases enter in a state of exceedingly fine division, the upper portion of the column being provided with an expansion valve through which the washed expanded gases pass downwards through an expansion coil or the like, through the washing liquid, for the purpose of cooling the same, and then proceed to the cooling.

(6). A process of the kind set forth in Claim 1 for utilizing natural gases or petroleum distillation gases by fractional condensation or absorption, in which the absorption medium is obtained by the preliminary condensation of the gas to be utilized, which is submitted to the gases still non-condensed, the cooling required for the condensation or absorption being obtained by the expansion of compressed gases or by evaporation of already condensed products under a relieved pressure, the gas being finally condensed by the use of high pressure and low temperature.

U. S. Patent No. 989,927, applied for in 1906 and issued April 18, 1911, to Geo. M. Saybolt, specifies: Claim (1) that natural gas of the kind supplied to cities be subjected at pressures not less than thirty pounds per square inch to a naphtha absorbing menstruum and by the aid of the same under high pressure, effecting the separation in industrial quantity from said gas of a natural gas naphtha, liquid at atmospheric pressure and temperature, and applicable to the uses of petroleum naphtha of similar volatility substantially as described.

Claim (2). The process of obtaining naphtha from combustible gas of natural origin and under ground source of the kind supplied by means of wells and pipe lines to the cities for consumption therein, which process consists in subjecting such gas in the requisite large amount on the way from its underground sources to its places of consumption and under a high pressure, not less than thirty pounds per square inch above atmospheric pressure, to a naphtha absorbing menstruum especially petroleum or hydrocarbon oil as specified, and by the aid of the same under said high pressure effecting the separation in industrial quantity from said gas, of a natural gas naphtha liquid at atmospheric pressure and temperature and applicable to the uses of petroleum naphtha of similar volatility, and then recovering the naphtha in liquid form from said menstruum by distillation under a low pressure, not more than about atmospheric pressure, substantially as described.

U. S. Patent No. 1,165,458, issued to John Snee, December 28, 1915, specifies a means of providing for the retention of lighter or more volatile oils contained in the product of oil wells, gas wells and gas wells that produce both oil and gas. The claims follow:

1. The method herein described consisting in discharging all of the liquid and gaseous hydrocarbon products of an oil well into a liquid and gas container, and absorbing the gaseous hydrocarbons which accumulate within the container above the surface of the liquid.

2. The method herein described consisting in discharging all of the liquid and gaseous hydrocarbon products of an oil well into a liquid and gas container beneath the fluid level of the latter, and removing and absorbing the gaseous hydrocarbons released from the liquid within the container.

3. The method herein described consisting in discharging all of the oil from an oil well into an oil and gas container, passing the gaseous products of the well into the oil thus discharged beneath the surface of the latter, and removing and absorbing the gaseous products released from the surface of the oil.

U. S. Patent No. 1,107,803 issued August 18, 1914, to H. Koppers, specifies that to extract naphtha from natural gas the latter is passed under pressure through a solvent oil in a cast iron bell washer which is relieved of pressure by placing it within a wrought-iron casing through which gas passes.

To the authors' knowledge the first large scale installation for extracting gasoline from natural gas was placed at Hastings, W. Va., by the Hope Natural Gas Company of Pittsburgh, Pa. The plant was put in operation in 1913 as a result of the Saybolt experiments. The process consists in causing the natural gas to bubble up through mineral seal oil, the latter being then sent to steam still for the separation of the gasoline and the absorbent oil being used over and over again. The gas is passed through the absorbing oil at the high pressure of the line. The hot oil from the stills is cooled in a double pipe cooler or exchanger by the cold oil en route to still and further cooled by passing through pipes upon which running water falls.

The general process, except for the utilization of the gas under high pressure, is identical with the process of absorbing benzol and toluol vapors from coke-oven gases.

TESTING NATURAL GAS FOR GASOLINE CONTENT.

In addition to laboratory tests, the authors tested natural gas on a small scale with the absorber shown in figure 1.

It is built on the principle of a laboratory gas-washing bottle of the Friedrick type. This absorber was made of iron pipe and thoroughly welded. It is about three feet high, and the two main barrels, A and B, were made of 4" pipe. The gas entering bubbles up through the absorbing oil at C and passes through the coil of pipe F, and into the part A and out at E. This apparatus along with a small gas meter can be easily transported to any desired place for the purpose of making small scale tests.

After the oil contained in the absorber had absorbed all of the gasoline that was desired, a portion of it was withdrawn and subjected to distillation to obtain the gasoline, which was measured and the yield of gasoline per 1,000 cubic feet of natural gas thus determined. This small absorber was designed to show the maximum yield of gasoline possible to obtain.

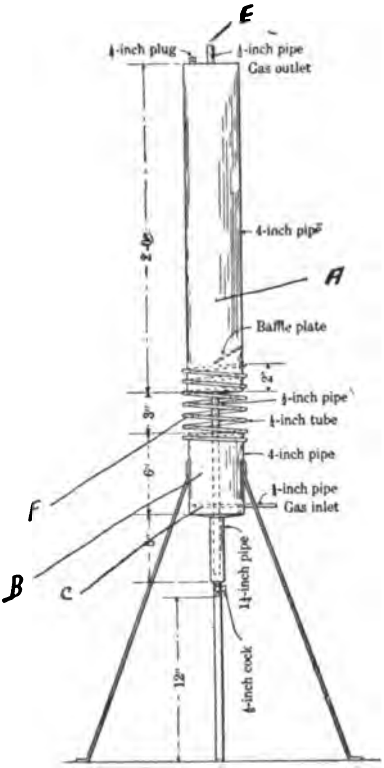

Figure 1.
Small absorber for Testing natural Gas
for Gasoline Content

The process of extracting gasoline from natural gas by passing the latter through oil, simply consists in the solution of the gasoline in the absorbent. In passing natural gas with its gasoline vapor through an absorbent, there will occur a point in the solution process when a particular oil will not take up any more gasoline. The authors determined that in the case of mineral seal oil this saturation was 28 per cent, as regards tests they conducted. In conducting the test natural gas was passed through mineral seal oil, using the small absorber shown in figure 1. By a percentage saturation of 28 is meant that the amount of gasoline absorbed was 28 per cent of the final total volume of gasoline and oil.

But in the practical work of absorbing gasoline from natural gas, the saturation percentage of the gasoline in the oil cannot be carried that far. It was found from actual tests that when the saturation of the gasoline exceeded 4 per cent, some of the gasoline in the natural gas was passing through the oil unabsorbed, i. e., the extraction was not complete. As a saturation percentage of 4 per cent was exceeded more and more gasoline was absorbed, of course, from the natural gas[7] but at the same time an increasingly small amount of gasoline appeared in the exit gases. This small amount was always less than the amount absorbed until a saturation of 28 per cent was reached, when the amount absorbed was equal to the amount given off, i. e., a condition of equilibrium was reached.

Therefore in all tests made both on the small absorbers and on the larger experimental plants a close tab was kept on the saturation percentage of the gasoline in the absorbent. In using the small absorber the practice was to pass 100 to 200 cubic feet of gas through the oil at the rate of about 100 to 300 cubic feet per hour.

Two different oils were used as the absorbing medium in extracting gasoline from the natural gas in conjunction with those tests in which steam distillation was used to finally separate the gasoline from the absorbent. These oils were petroleum distillates. Their characteristics as determined by E. W. Dean, petroleum chemist of the Bureau of Mines, follow:

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[7] This would occur up to 28 per cent saturation.

MINERAL SEAL.

Flash Point (Pensky-Martin closed apparatus).........	135°C., 275°F.
Burning Point (Pensky-Martin open apparatus)........	160°C., 311°F.
Specific Gravity (water = 1)..........................	.850

Upon distillation the first drop appeared at 225° C. (405° F.) and 6.2 per cent distilled up to 275° C. (527° F.).

STRAW OIL.

Flash Point	180°C., 361°F.
Burning Point	208°C., 416°F.
Specific Gravity (water = 1)..........................	.851

First drop distilled at 250° C. (482° F.) and began to distill in quantity at 275° C. (527° F.).

The main requirement of an absorbent oil is that its boiling points vary sufficiently from the boiling points of gasoline so a separation of the two can be made by distillation.

DESCRIPTION OF EXPERIMENTAL PLANTS USING MINERAL SEAL OIL AND STEAM DISTILLATION.

While the tests were under way, using the small scale experimental plant shown in figure 1, tests on a much larger scale were made with the plant shown in figure 2. This plant was capable of continuous operation in that natural gas was continuously passed through the absorbing oil and the latter after leaving the absorbers, charged with gasoline, were pumped to the steam stills where the gasoline was removed and the oil pumped back to the absorbers to receive another charge of gasoline. This plant has a capacity of from 15,000 to 30,000 cubic feet per hour.

A diagrammatic view of the plant is shown in figure 2.

The gas enters the absorbing tank at C and the oil enters at B. Together they pass into the T pipe D and pass from there through many small holes into the oil contained in the absorber A. The gas bubbling up through A is stripped of its gasoline by absorption in the oil and passes out of the absorber as shown and goes on its way to the cities and other places for consumption.

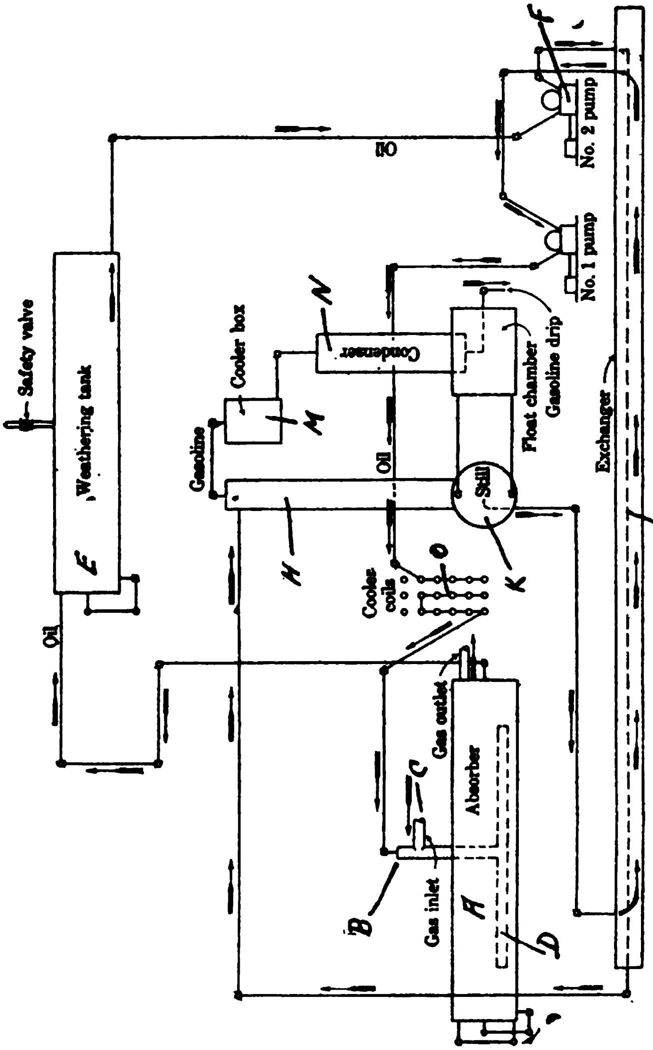

Figure 2
Experimental Plant for absorbing gasoline from natural gas

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The oil charged with gasoline passes first to the weathering tank E, where the lighter portions of the gasoline are released through the safety valve. (Set at about 3 lbs. per square inch.) Next the oil enters the pump F and is pumped through the heat exchanger G and from there into the rock tower H of the steam still K. Live steam enters this still and distills the gasoline from the oil. The cooler M is provided to separate the water (condensed steam) from the gasoline. The gasoline is condensed in the condenser N and flows out of the system at the gasoline drip.

The hot oil after having been freed of its gasoline is passed through the heat exchanger G (thereby heating the oil passing to the still) and from No. 1 pump is forced through the water coils O, upon which running water drops. The cooled oil then passes into the absorber A to receive another charge of gasoline. The operation is continuous, the oil being used over and over again.

In addition to the type of absorber shown at A in figure 2 several other types of absorbers were used. The most efficient was a vertical or tower absorber shown in figure 3. Oil enters as shown at A and drops onto and through a column of stones of about the size of a fist. Gas enters near the base of the tower and flows counter current to the oil and out of the gas pipe at the top of the column.

YIELD OF GASOLINE USING THE SMALL ABSORBER SHOWN IN FIGURE I AND THE PLANT SHOWN IN FIGURE 2.

In Table 1 are shown data of tests, using the "plant" shown at figure 2. In test No. 1 the tower absorber was used in test No. 2 the absorber shown connected with the plant. The tower absorber gives the best results.

At Table 2 are shown some results using the small absorber. The yield obtained with the small absorber exceeded that obtained with the larger absorber by about .3 of a pint.

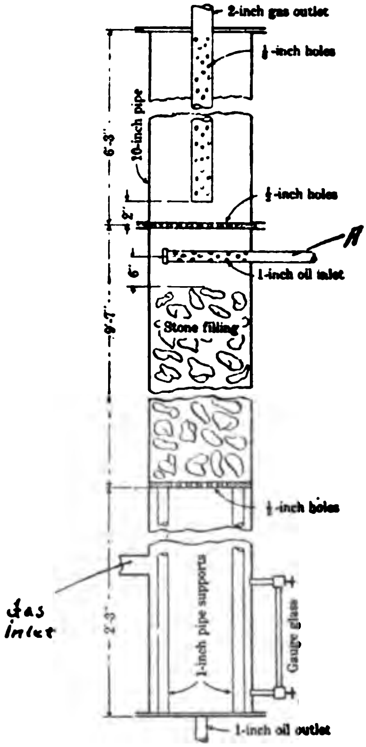

Figure 3
Vertical absorber filled with stones.

TABLE 1.

Tests of Natural Gas Using Different Absorbers.

Kind of Absorber.	Tower Absorber.				Bubbling Absorber.			
Test No.	1				2			
Time	8	9	10	11	8	9	10	11
Pressure at inlet to absorber, lbs. per sq. in.	222	215	211	211	225	220	216	215
Pressure on still, lbs. per sq. inch	3	3	2.75	2.75	3	3	2.75	2.75
Temperature of oil, °F.	58	64	66	68	66	66	66	68
Temperature of oil outlet still, °F.	207	210	208	209	212	212	212	210
Temperature of vapor outlet cooler, °F.	142	170	164	176	170	172	184	172
Temperature of cooling water, °F.	52	52	52	52	52	52	52	52
Temperature of still, °F.	218	216	216	216	216	216	216	215
Temperature of oil outlet absorber, °F.	54	58	60	62	60	58	60	68
Sp. gr. absorbing oil inlet to absorber, °B.	34.2	33.7	33.5	34.4	34.5	34.5	34.5	34.4
Sp. gr. absorbing oil outlet from absorber, °B.	36.4	36.2	36.0	35.8	35.0	35.2	35.0	34.4
Yield gasoline, c. c.		17000	16000	16310		9200	9600	11300
Gravity gasoline, °B.		85.2	85.5	85.8		80.3	80.3	82.3
Gravity of refrigerator gasoline, °B.		91.1	91.8	90.5		90.3	92.0	90.6
Volume of refrigerator gasoline, c. c.		1860	2200	2080		2335	2130	1810
Amount of gas passed, cubic feet	73,800							
Yield of gasoline per 1000 cub. ft., total pints	1.57				1.18			

Flow of gas	24,600 cub. ft. per hour	Rate of flow of gas	21,600 cub. ft. per hour
Gallons of oil circulated per 1000 cub. ft. of gas	7.9	Gallons of oil circulator per 1000 cubic feet of gas	8.7

Refrigerator gasoline means that obtained by condensing vapors escaping from the still and condensed by the water in the condenser.

TABLE 3.

Tests with Small Absorber. Mineral Seal Oil Use. Three Absorbers in Series for Each Test.

Test number	No. 1 Test.			No. 2 Test.		
Number of absorber	1	2	3	1	2	3
Rate of flow of gas, cubic feet per hour	360	360	360	240	240	240
C. c. of oil used	1,750	1,500	1,500	1,750	1,500	1,500
Cubic feet of gas used	202	202	200	200	200	200
Temperature of oil, degrees Fahrenheit	58	60	62	60	60	64
Amount of oil and gasoline recovered	1,950	1,580	1,550	1,980	1,600	1,570
Saturation of oil with gasoline, per cent	7.9	2.3	.4	7.0	2.1	.2
Amount of sample taken for distillation test, cubic centimeters	650	527	517	660	533	523
Amount of gasoline obtained from sample by distillation, cubic centimeters	45	12	2	46	11	1
Calculated amount of gasoline, entire oil and gasoline recovered	135	36	6	138	33	1
Boiling point of gasoline, degrees Fahrenheit	110-250	150-250	150-250	110-250	145-250	150-250
Cubic centimeters of oil used per 1,000 cubic feet of gas	8,750	7,500	7,500	8,750	7,500	7,500
Pints of gasoline recovered, obtained per 1,000 cubic feet of gas	1.42	.36	.06	1.46	.35	.03
Specific gravity of gasoline, degrees Baume	84	....	....	84	....	....
Total amount of gasoline from three absorbers, pints per 1,000 cub. ft. of gas	1.84			1.84		

CHANGE IN COMPOSITION AND QUANTITY OF THE NATURAL GAS BEFORE AND AFTER THE EXTRACTION OF GASOLINE.

Tests which the authors made of the natural gas before and after treatment for the absorption of gasoline follow:

TESTS OF FRESH GAS.

Combustion Analysis.

	Low Field Gas. Per Cent.	*Line L Gas. Per Cent.*
CO_2	trace	trace
CH_4	76.3	83.9
C_2H_6	18.4	11.7
N_2	5.3	4.4
Total	100.0	100.0

	Low Field Gas.	*Line L Gas.*
Specific gravity	0.68	0.63
Absorption in Russian white oil[8]	17.0	15.0
Gross heating value per cubic foot at 0°C. and 760 mm. pressure	1155.0 B.t.u.	1111.0 B.t.u.

The foregoing tests were made of gas that had not been treated by the absorption process. The following table shows tests of the same gas after it had been passed through absorbers containing Mineral Seal oil, and after gasoline had been extracted from it.

TESTS OF TREATED GAS.

Combustion Analysis.

	Low Field Gas. Per Cent.	*Line L Gas. Per Cent.*
CO_2	trace	trace
CH_4	79.7	88.3
C_2H_6	14.1	7.9
N_2	6.2	3.8
Total	100.0	100.0

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[8] This Russian white oil is used in the same way that Claroline is used, and described on page 32, Bull. 88, Bureau of Mines.

	Low Field Gas.	*Line L Gas.*
Specific gravity	0.65	0.61
Absorption in Russian white oil........	16.7	14.0
Gross heating value per cubic foot at 0°C. and 760 mm. pressure........	1111.0 B.t.u.	1087.0 B.t.u.

COMMENTS ON ANALYSES.

Differences between the natural gas before and after gasoline had been extracted are interesting. In the case of the low field gas, the heating value was lowered 44 B.t.u. or 3.8 per cent, due to the extraction of the gasoline. The specific gravity dropped from .68 to .65 and the proportions of paraffin hydrocarbons, calculated as methane and ethane, were altered. In the case of Line L gas, the heating value was lowered 24 B.t.u. or 2.2 per cent and the specific gravity dropped from .63 to .61.

The amount of gas that disappeared by conversion into gasoline is very small. It can be calculated this way: one gallon of gasoline produces about 32 cubic feet of vapor, or one pint produces 4 cubic feet. In their experiments the authors extracted from one to two pints of gasoline per 1,000 cubic feet of natural gas or from 4 to 8 cubic feet of natural gas disappeared from each 1,000 cubic feet of natural gas treated.

AMOUNT OF OIL USED PER THOUSAND CUBIC FEET OF NATURAL GAS TO OBTAIN THE LARGEST YIELD OF GASOLINE.

A large number of tests were made with different absorbers to determine the proper amount of oil to be used per 1,000 cubic feet of natural gas in order to obtain the highest yield of gasoline. It was found that using the absorber shown in figure 2 the best results were obtained when about 7 gallons of oil were circulated per 1,000 cubic feet of gas. Using the tower absorber shown in figure 3 the amount of oil circulated could be considerably decreased and just as good results obtained by circulating 4 gallons of oil per 1,000 cubic feet of gas. Instead of decreasing the amount of oil, the practice of the authors was to keep the oil rate at about 7 gallons and increase the gas rate. The best results were obtained with the tower absorber by passing about

28,000 cubic feet of gas per minute and circulating about 7 to 8 gallons of oil.

DISTILLATION TEST OF GASOLINE

The gasoline obtained by absorption in mineral seal oil and steam distillation rather consistently had a specific gravity on the Baumé scale of about 80°. One of many distillation tests that the authors made of it are shown in Table 1. These tests were made on gasoline obtained from the large scale experimental plant shown in figure 2.

DISTILLATION TEST OF GASOLINE OBTAINED BY ABSORPTION METHOD.

Experimental Plant. December 29, 1916.
Specific Gravity of Mixture = 80° Baumé.

Distillation Temperature, Degrees Fahrenheit.	*Amount of Distillate by Volume, Per Cent.*	*Specific Gravity of Distillate, Degrees Baumé.*
80-110	10	91.8
110-124	20	89.0
124-136	30	86.7
136-146	40	83.4
146-158	50	80.4
158-172	60	77.4
172-188	70	73.3
188-208	80	70.2
208-244	90	65.0
244-290	93	63.1
Loss	7	

This test shows the gasoline to be very high grade.

EVAPORATION LOSS OF GASOLINE OBTAINED BY ABSORPTION PROCESS FROM NATURAL GAS AND A COMPARISON WITH DIFFERENT BLENDS AND WITH REFINERY GASOLINE.

In Table 3 there is shown the loss by evaporation, using different grades of gasoline. The liquids were exposed in glass cylinders, 12 inches high, 4 inches in diameter, and of 1000 cubic centimeters capacity. The first column shows the evaporation loss when the gasoline obtained from natural gas by the absorption process was exposed to the air. The second column shows the evaporation loss, using refinery gasoline obtained from the Standard Oil Company.

The absorption process gasoline lost 10.5 per cent at the end of the first hour. This is far better than casing-head gasoline, much of which will lose 25 to 30 per cent of its volume by "weathering" after standing one hour.

TABLE 3.

Evaporation Loss of Gasoline.

Kind of Gasoline.	*From Absorption Process.*	*Refinery.*
Specific gravity of gasoline at start, degrees Baumé	81.1	60.4
Temperature of gasoline, degrees Fahrenheit	56	62
Temperature of room, degrees Fahrenheit	70	70
Volume of gasoline at start, cubic centimeters	1000	1000
Volume of gasoline after 24 hours, cubic centimeters	895	976
Volume of gasoline after 48 hours, cubic centimeters	840	955
Volume of gasoline after 72 hours, cubic centimeters	800	924
Specific gravity of gasoline after 24 hours, degrees Baumé	79.6	.....
Specific gravity of gasoline after 48 hours, degrees Baumé	76.5	.....
Specific gravity of gasoline after 72 hours, degrees Baumé	76.0	58
Temperature of gasoline after 24 hours, degrees Fahrenheit	56	.....
Temperature of gasoline after 48 hours, degrees Fahrenheit	....	.....
Temperature of gasoline after 72 hours, degrees Fahrenheit	61	60
Evaporation loss of gasoline after 24 hours, per cent.	10.5	2.4
Evaporation loss of gasoline after 48 hours, per cent.	16.0	4.5
Evaporation loss of gasoline after 72 hours, per cent.	20.0	7.6

VAPOR TENSION TESTS OF GASOLINE OBTAINED BY OIL ABSORPTION AND STEAM DISTILLATION.

Many vapor tension tests were made of the gasoline. Some of these tests are shown in the following table. It will be seen that the material does not develop excessive pressures with rise of temperature and that it comes well within the specification for gasoline that can be shipped in tank cars.

VAPOR PRESSURE TESTS OF GASOLINE PRODUCED BY OIL ABSORPTION AND STEAM DISTILLATION PROCESS.

Date.	12/15/15	12/16/15	12/22/15	12/23/15
Specific gravity of gasoline, °B...	79	78	77.5	81.5
Vapor pressure, at 70°F., lbs. per sq. inch	1.25	1.0	.5	1.25
Vapor pressure, at 90°F., lbs. per sq. inch	1.50	1.5	1.0	2.0
Vapor pressure, at 100°F., lbs. per sq. inch	2.75	2.5	2.5	4.75

The rules of the Interstate Commerce Commission[a] regarding the shipment of natural gas gasoline follow:

REGULATIONS FOR THE TRANSPORTATION ON RAILROADS OF NATURAL GAS GASOLINE.

"Liquefied petroleum gas is a condensate from the 'casing head gas' of petroleum oil wells, whose vapor tension at 100° F. (38° C.) to 90° F. (32° C.), Nov. 1 to Mar. 1, exceeds 10 lbs. per square inch. Liquefied petroleum gas must be shipped in metal drums or barrels which comply with 'shipping container specification No. 5' or in tank cars especially constructed and approved for this service by the Master Car Builders' Association. When the vapor tension at 100° F. (38° C.) exceeds 25 lbs. per square inch, cylinders as prescribed for compressed gas must be used."

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[a] From "Regulations of the Interstate Commerce Commission for the Transportation of Explosives and Other Dangerous Articles by Freight and Express, and Specifications for Shipping Containers," published by the Bureau for the Safe Transportation of Explosives and Other Dangerous Articles, in January, 1912; effective March 31, 1912.

UNCONDENSED VAPORS FROM THE STILL.

In the process of distillation of the gasoline from the mineral seal oil by means of steam, an appreciable quantity of uncondensed vapors escaped into the air, hence some of them were liquefied by passing the vapors through a 1" pipe about 8' long, inside another pipe 2" in diameter and 8' long. Compressed natural gas which had been used to run one of the oil pumps (in place of steam) was expanded through the larger pipe to cool and condense as much of the vapors as possible. A temperature of 0° to 4° F. was obtained in this manner. The following table shows the vapor pressure and other data regarding these condensed vapors.

DATA REGARDING UNCONDENSED VAPORS FROM STILL.

Vapors from Condenser.

130,000 cubic feet of natural gas used in the test and 450 cubic feet of vapor passed through refrigerator.

Yield	3¼ gallons per 130,000 cubic feet of natural gas used at plant.
Vapor tension test	5 lbs. at 70°F.
	8¼ lbs. at 90°F.
	11 lbs. at 100°F.
Specific gravity of refrigerator gasoline	94.9° Baumé.

Evaporation Test.

Time, p. m.	1:15	1:20	1:35	2:00	2:15
Volume (cc.)	100	75	65	55	50
Temperature, °F.	....	60	70	84	90
Per cent loss	....	25	35	45	50

The yield of gasoline obtained from the steam still during this test was .94 pints of 80° Baumé gasoline per 1000 cubic feet of gas. The yield of gasoline from the refrigerator was 3¼ gallons per 130,000 cubic feet of natural gas, or .2 pints per 1000 cubic feet; .2 plus .94 pints = 1.14 pints total yield.

TABLE 4.

Effect of Pressure on Yield of Gasoline, Using Three Apparatus in Series like that Shown at Figure 1.

Test No.	1			2		
Date	January 26, 1916.			January 29, 1916.		
Time	2:48 to 3:58 P. M.			2:25 to 3:40 P. M.		
Kind of oil used	Mineral Seal			Mineral Seal		
Specific gravity of oil, degrees Baumé	34.2			35.0		
Amount of oil used, cubic centimeters	1750	1500	1500	1750	1500	1500
Pressure on absorber, lbs. per sq. inch	Atmospheric			20 lbs. gauge		
Gas rate by meter, cubic feet per hour	79					
Ratio, c. c. of oil to 1000 cubic ft. of gas	17500	15000	15000	17500	15000	15000
Cubic feet of gas consumed	100	100	100	100	100	100
Amount of liquid recovered, c. c.	1770	1505	1510	1845	1515	1520
Sp. gr. of liquid recovered, degrees Baumé	35.1	34.5	34.4	35	35.2	34.7
Temperature of liquid recovered, degrees Fahr.	68	67	66	66	68	69
Per cent. saturation of liquid recovered	1.2	.6	.3	2.3	1.2	.5
Increase in c. c. of liquid recovered	20	5	10	95	15	20
Increase, per cent., of liquid recovered	1.1	.3	.7	5.4	1.0	1.3
Amount of sample for distillation, cubic centimeters	500	502	503	615	505	506
Temperature of condenser bath, degrees Fahr.	48	48		46		
Amount of distillate, c. c.	7.0	3.0	1.5	14.0	5.8	2.7
Temperature range of distillate, degrees Fahr.	166-260	199-260		160-260	138-260	
Amount of gasoline obtained, cubic centimeters	21.0	9.0	4.5	42.0	17.4	8.1
Amount of gasoline obtained, pints per M cubic feet	.44	.19	.08	.888	.368	.171
Total pints of gasoline per M cubic feet of gas	.71			1.427		

TABLE 4 — Concluded.

Test No.	3			4			5		
Date	January 30, 1916.			January 30, 1916.			January 31, 1916.		
Time	9:35 to 10:45 A. M.			1:05 to 2:25 P. M.			8:15 to 9:37 A. M.		
Kind of oil used	Mineral Seal.			Mineral Seal.			Mineral Seal.		
Specific gravity of oil, degrees Baumé	35.0			35.0			34.2		
Amount of oil used, cubic centimeters	1750	1500	1500	1750	1500	1500	1750	1500	1500
Pressure on absorber, lbs. per sq. inch	40 lbs. gauge			85 lbs. gauge			110 lbs. gauge		
Gas rate by meter, cubic feet per hour	85			75					
Ratio, c. c. of oil to 1000 cub. ft. of gas	17500	15000	15000	17500	15000	15000	17500	15000	15000
Cubic feet of gas consumed	100	100	100	102	102	102	100	100	100
Amount of liquid recovered, c. c.	1825	1555	1535	1850	1550	1545	1875	1575	1550
Sp. gr. of liquid recovered, degrees Baumé	35.7	35	34.8	35.4	35.2	35.2	36.7	35.5	35.5
Temperature of liquid recovered, degrees Fahr.	64	68	69	68	70	70	64	66	66
Per cent. saturation of liquid recovered	2.6	1.0	—	2.8	1.02	.8			
Increase in c. c. of liquid recovered	75	55	35	100	50	45	125	75	50
Increase, per cent., of liquid recovered	4.3	3.7	2.3	5.14	3.3	3	7.15	5.0	3.3
Amount of sample for distillation, cubic centimeters	608	518	512 sample lost before distillation	617	516	515			
Temperature of condenser bath, degrees Fahr.	46			52	52	52	48	48	48
Amount of distillate, c. c.	15.6	5.2		20.8	5.2	4.0	21.1	1.0	.3
Temperature range of distillate, degrees Fahr.	130–260			120–260	130–260				
Amount of gasoline obtained, cubic centimeters	46.8	15.6		62.4	15.6	12.0	63.3	3.0	1.2
Amount of gasoline obtained, pints per M cubic feet	.989	.33		1.31	.33	.25	1.34	.6	.025
Total pints of gasoline per M cubic feet of gas	1.489 Estimated loss .17 (See previous test)			1.89			1.97		

EFFECT OF PRESSURE AND TEMPERATURE ON THE ABSORPTION OF GASOLINE FROM NATURAL GAS.

The authors found that the yield of gasoline was considerably affected by the pressure under which the absorption was effected. This is to be expected. In one test an increase in the pressure of the gas from atmospheric to 110 lbs. per square inch increased the yield from .7 pints to about 1.8 pints per 1000 cubic feet of gas.

An increase in the temperature of the oil in the absorber from about 75° F. to 85° F. lowered the yield about .3 pints per 1000 cubic feet of gas.

COST DATA

As a result of the experiments conducted to date, a much larger plant is contemplated, capable of handling about 50 million cubic feet of natural gas per day. Exact figures regarding the cost of installing such a plant cannot be given at the present time. It is believed, however, that a conservative estimate is $1.00 to $1.50 per thousand cubic feet of gas handled per day for a "plant" capable of handling 60 to 90 million cubic feet and up to $2.00 per thousand cubic feet of gas for a plant of 30 million cubic feet or less. The returns are large. At $1.00 per thousand cubic feet, a plant to handle 60 million cubic feet would cost $60,000. If only one pint of gasoline was extracted from each 1000 cubic feet of gas per day, there would be extracted from 60 million cubic feet 7,500 gallons of gasoline. At $.20 per gallon for gasoline, this is $1,500 per day. If natural gas sells for 30c per 1000 cubic feet, the extraction of the gasoline adds about 2 cents per 1000 to the selling price of the gas.

COMBINATION PROCESS OF ABSORPTION OF GASOLINE FROM NATURAL GAS BY MEANS OF NAPHTHA AND MINERAL SEAL OIL

This process, heretofore described, of extracting gasoline from natural gas by absorption, consisted in first passing the natural gas through mineral seal oil and then separating the absorbed gasoline from the oil by steam-distillation. This process resulted in obtaining from one gas the authors experimented with about 1.2 pints of gasoline per 1000 cubic feet of gas, and another gas about 1.8 to 1.9 pints of gasoline. This has reference to tests made with the small absorber shown in figure 1.

In using the mineral seal oil as the absorbent, it was found that the increase in volume of the mineral seal oil after passing natural gas through it, did not correspond with the quantity of gasoline subsequently obtained from the oil by distillation. This was due to the fact that a considerable quantity of the lighter hydrocarbons were absorbed from the natural gas, increasing the volume of the mineral seal oil, but escaping as a gas when the oil was subjected to distillation to obtain the absorbed gasoline.

The loss of material appeared to be considerable, so a solution was sought that would result in obtaining this material wasted by the oil absorption and distillation process. Therefore several tests were made, using the small absorbers of the type shown in figure 1 with naphtha, specific gravity 55° Baumé in the first two absorbers and mineral seal oil in the third absorber. The object was to absorb as much of the gasoline as possible, including the lighter hydrocarbons, in the first two absorbers and the rest of the gasoline in the mineral seal oil. Table No. 5 shows the results of these tests.

TABLE 5.

Extraction of Gasoline from Natural Gas by Passing the Latter Through Naphtha.

Test No.	1			2			3		
Oil or naphtha used	Naphtha	Naphtha	Mineral seal	Naphtha	Naphtha	Mineral seal	Naphtha	Naphtha	Mineral seal
Sp. gr. of oil or naphtha, °B	53.5	53.5	32.5	55.5	55.5	34.2	55.5	55.5	33.9
Pressure on gas, lbs. per sq. inch	235	235	235.	230	230	230	235	235	235
Gas rate, cubic feet per hour	50	50	50	55	55	55	180	180	180
Amount of gas used, cubic feet	200	200	200	105	105	105	200	200	200
Oil used, c. c.	1750	1500	1500	1750	1500	1500	1750	1500	1500
Oil recovered, c. c.	1950	1640	1565	1925	1560	1510	1850	1555	1600
Sp. gr. of liquid recovered, °B	61.6	60.0	37.7	59.6	58.0	36.3	58.2	54.8	36.2
Temperature of liquid in absorber, °F	27	29	26	19	19	19	54	54	60
Increase in liquid in absorber, c. c.	200	140	65	175	60	10	100	55	100
Sample of mineral seal oil for distillation			500			503			533
Amount of gasoline distilled from mineral seal oil, c. c.			7			2			25
Yield of gasoline, pints per 1000 cubic ft. of gas	2.114	1.480	.687	3.53	1.21	.12	1.06	.58	1.06
Total yield, pints per 1000 cubic ft. of gas		4.28			4.86			2.70	

TABLE 5 — Concluded.

Test No.	4			5			6		
Oil or naphtha used	Naphtha	Naphtha	Mineral seal	Naphtha	Naphtha	Mineral seal	Naphtha	Naphtha	Mineral seal
Sp. gr. of oil or naphtha, °B	55.5	55.5	34.2	55.5	55.5	34.2	55.0	55.0	34.2
Pressure on gas, lbs. per sq. inch	235	235	235	235	235	235	235	235	235
Gas rate, cubic feet per hour	54	54	54	180	180	180	56	56	56
Amount of gas used, cubic feet	217	217	217	100	100	100	202	202	202
Oil used, c. c.	1750	1500	1500	1750	1500	1500	1750	1500	1500
Oil recovered, c. c.	2040	1600	1560	1810	1525	1560	2020	1595	1530
Sp. gr. of liquid recovered, °B	62.0	58.6	36.1	57.3	56.8	35.9	60.9	58.9	36.1
Temperature of liquid in absorber, °F	28	28	26	60	60	66	18	18	18
Increase in liquid in absorber, c. c.	290	100	60	60	25	60	270	95	30
Sample of mineral seal oil for distillation			520			520			500
Amount of gasoline distilled from mineral seal oil, c. c.			7			16			5.6
Yield of gasoline, pints per 1000 cubic ft. of gas	2.92	.97	.21	1.27	.53	1.27	2.90	.99	.17
Total yield, pints per 1000 cubic ft. of gas		4.10			3.07			4.06	

COMMENTS ON TESTS.

It will be observed that the gasoline extracted from the natural gas by passing the latter through naphtha amounted to 4.86 gallons per 1000 cubic feet of gas in the case of one test. The lowest yield was 2.70 gallons. The increase in yield over the oil absorption and distillation method varied between 300 and 500 per cent.

In test No. 1 the specific gravity of the naphtha was raised from 53.5° Baumé to 61.6° Baumé in the first absorber and to 60° Baumé in the second absorber. The increase in volume of naphtha in first absorbers was 200 cc. or 11.5 per cent, and in the second absorber 140 cc. or about 9.3 per cent.

The greatest increase in volume and specific gravity of the naphtha was obtained in No. 1 absorber, No. 4 test. The specific gravity of the naphtha was raised from 55.5° Baumé to 62° Baumé and the increase in volume was 290 cc. or about 16.6 per cent.

The vapor pressure of the resulting naphtha in No. 1 absorber, No. 4 test, was 5 pounds per square inch at 100° F., and the evaporation or weathering loss was 5 per cent in 24 hours. During this weathering test the temperature of the gasoline raised from 54° F. at the start to 64° F. at the finish. The temperature of the room changed from 56° F. to 64° F. The temperature of the naphtha had much influence on the results of the tests. The highest yield was that shown in No. 2 test where the temperature of the naphtha was 19° F. This test was conducted in the open air on a cold winter day. However, even at a temperature of 60° F. a yield as high as 3.07 pints of gasoline per 1000 cubic feet of gas was obtained. Test No. 6 was instructive in that the vapor pressure of the resulting naphtha in No. 1 and No. 2 absorbers was 14 pounds per square inch at 100° F. In other words, its vapor pressure exceeded that prescribed for gasoline to be shipped in tank cars.

In summing up the use of naphtha as an absorbent for extracting gasoline from natural gas, it can be stated that a greater yield can be obtained than by using the oil absorption and distillation process, as much as 300 per cent greater at ordinary temperatures and 400 to 500 per cent greater if temperatures as low as 18° to 19° F. are employed. A further advantage lies in the fact that the resulting naphtha with its absorbed gasoline does not have to be subjected to distillation to obtain gasoline but can be sold as prepared.

An objection to it lies in the fact that a large amount of naphtha would have to be handled in large scale operations. Mineral seal oil can be used over and over again with but slight loss while the naphtha would have to be constantly received.

The greatest increase in volume of the naphtha was 16.6 per cent in No. 4 test. This amounts to about 6 to 7 times as much naphtha as gasoline, i. e., for each tank of gasoline extracted from the natural gas there would be needed 6 or 7 tanks of naphtha. One cannot absorb too much gasoline in the naphtha else the vapor pressure of the resulting mixture exceeds the limit (10 pounds per square inch at 100° F.) set for the transportation of gasoline in tank cars.

If an absorption gasoline plant could be located at or close to a refinery where a large supply of naphtha was available, the difficulty and trouble of transporting large quantities of naphtha into the absorption plant would be largely overcome, but in most, and perhaps all, cases this is not feasible.

One can look at the problem in the following way:

By the oil absorption process there is obtained one-third as much gasoline as by the naphtha process. One tank car (10,000 gallons) of the absorption process gasoline sells for about 20 cents per gallon, or $2,000. (This figure, however, will vary.) Three tank cars will sell for $6,000, or an increase of $4,000. But in order to secure this increase of $4,000, about 7 tank cars of naphtha would have to be brought into the absorption plant, i. e., at least seven times as much naphtha would have to be handled as of gasoline extracted.

ADAPTABILITY OF THE ABSORPTION PROCESS TO CASING HEAD NATURAL GAS.

The authors have not made experiments to date regarding the applicability of the absorption process to casing head natural gas, i. e., natural gas containing a comparatively large proportion of gasoline vapor and at present treated by compression and condensation methods.

The "dry" natural gases used in the experiments described in this report contained from 1 to 2 pints of gasoline per 1000 cubic feet of gas, and at least 4 gallons of absorbing oil were circulated for each 1000 cubic feet of gas to obtain the highest yield of gasoline. On the same basis, about 32 gallons of oil would have to be circulated for each 1000 cubic feet of casing head natural gas that carried 1 gallon of gasoline per 1000 cubic feet of gas, or about 64 gallons of oil for casing head natural gas containing 2 gallons of gasoline per 1000 cubic feet of gas. If 30,000 cubic feet of gas per hour were treated, then 30 x 64 = 1920 gallons of oil would have to be circulated per hour. There are many casing head compression plants treating 30,000 to 50,000 cubic feet per hour and obtaining 2 gallons of gasoline per 1000 cubic feet of gas.

Another possibility is the working of the two processes together on casing head gas. The gas might be compressed and condensed in the ordinary manner first and the exit gases passed through a small absorbing plant to extract gasoline not completely extracted by the compression method. Waste gases from compression plants contain gasoline that has not been completely extracted. It does not do any good to pass them back through the plant again because they would be subjected to the same process as before, but it might be feasible to pass them through an absorption plant. A point in favor of the absorption process as compared to the compression and condensation method lies in the fact that the gasoline obtained by the former process is not so "wild" as that usually obtained by the latter method.

At present the application of the process to casing head gases is largely conjecture on the part of the authors, but experiments will be conducted in the future along this line. However, one is safe in saying that there is a great deal of casing head natural gas at present going to waste that, while considered too lean to work by the compression method, could be treated by the absorption method.

SUMMARY.

The absorption method of extracting gasoline from natural gas consists in bringing natural gas in contact with an oil heavier than gasoline, i. e., a petroleum distillate of about 34° Baumé, letting the absorbent absorb the gasoline from the natural gas, and then separating the gasoline from the oil by distillation. The oil is simply used as a carrier of the gasoline from the absorption tank to the still. It is used over and over again. This method is different from the extraction of gasoline from casing-head natural gases by compression and condensation methods. By the latter method natural gases that are comparatively rich in gasoline vapor are treated, i. e., those usually carrying upwards from three-fourths gallons of gasoline per 1000 cubic feet of natural gas. So called "dry" natural gas can not be treated by this method. By "dry" natural gases are meant those used in cities, towns and factories for heating, lighting and other purposes. The quantity consumed of this kind of natural gas amounted in 1914 to 591 billion cubic feet. Most of this natural gas carries gasoline to the extent of one to two pints per 1000 cubic feet of gas. Probably 75,000,000 gallons of gasoline per year can be obtained by treating much of this natural gas at the present time.

In the case of two natural gases that the authors of this paper experimented with, the heating value was only lowered 3.8 per cent in one case and 2.2 per cent in another case by the extraction of the gasoline. The amount of natural gas that disappears varies from 4 to 8 cubic feet of gas per 1000 cubic feet of gas.

Besides the obtaining of valuable fuel, gasoline, a further advantage of the process lies in the resultant protection of pipe lines against the deteriorating effect of gasoline on coupling rubbers. The replacing of these rubbers and the repairing of broken connections and loss of natural gas thereof has been a large item of expense in gas transportation companies' operating costs.

The absorption process of extracting gasoline from natural gas assumed industrial importance as the demand for gasoline increased. The scheme is practically identical with the process of extracting benzole and toluol, (light oil) from coke oven gases, a process used for years in Germany and to a very large extent during the years 1915 and 1916 in the United States. A difference lies in the fact that coke oven gases are treated at about atmospheric pressure while natural gas is treated at pressures as high as 200 to 300 pounds per square inch. This is an economic necessity because natural gas is transported at high pressures and it is not desirable to disturb the system.

To the best of the authors' knowledge the first large scale installation for extracting gasoline from natural gas by the absorption process was placed at Hastings, West Virginia by Hope Natural Gas Company of Pittsburgh, Pa. Operations commenced in 1913. The plant was built following experiments by Geo. M. Saybolt.

Natural gas can be tested as regards the practicability of extracting gasoline from it by the absorption process by two methods. One is a laboratory method whereby the gasoline is frozen out of the natural gas and its pressure and volume determined. The other method is a field method.

A small absorber and a gas meter can be taken to the well or pipe line to be tested for natural gas, the gas passed through the absorbent and the extracted gasoline distilled from the oil. In other words, a duplicate on a small scale of the commercial method.

All natural gases except those that contain methane only as the combustible gas contain gasoline vapor. However, in some cases the amount contained may be very small. This is sometimes due to the fact that gas wells are under very high pressures and this high pressure keeps the gasoline back in the well. But even those high pressure wells represent potential sources of gasoline supply in that natural gas will carry commercial quantities of gasoline vapor as the pressure declines.

Natural gas from two different fields that the authors tested contained gasoline to the extent of one pint per 1000 cubic feet in one case and 1.5 pints in another case. About 50,000,000 cubic feet of natural gas per day was available for treatment.

Oils which the authors experimented with to act as absorbents for the gasoline were about 35° Baumé gravity and started to boil at about 400° to 482° F. They were petroleum distillates. It is necessary that their boiling point be much higher than the boiling point of the gasoline to make the extraction of the latter by distillation easy.

Tests were made on a plant of fairly large proportions, capable of handling 15,000 to 30,000 cubic feet of gas per hour. The plant consisted of an absorber where the natural gas and absorbent oil were brought in contact with each other, a heat exchanger where the oil with its absorbed gasoline were heated before going to the still; a steam still where the gasoline was extracted from the oil; a cooler where the hot oil from the still was cooled before receiving another charge of gasoline; pumps, weathering tank, etc.

Several different types of absorbers were tried. The one giving the best results consisted of a stone tower down which the oil flowed and up which the gas passed.

An increase in the temperature of the oil in the absorber from about 75° F. to about 85° F. lowered the gasoline yield about .3 pints per thousand cubic feet of gas. An increase in the pressure of the gas from atmospheric pressure to 110 lbs., per square inch increased the yield from .7 pints to about 2 pints of gasoline per 1000 cubic feet of gas.

The specific gravity of the gasoline obtained varied between 77° Baumé and 85° Baumé. The boiling points ranged from 80° F. to 300° F. The evaporation loss was about 11 per cent in 24 hours as compared to straight refinery gasoline 60.4° Baumé, having an evaporation loss of about 2.4 per cent in 24 hours. The vapor pressure of the gasoline ranged from one pound at 70° F. to about 5 pounds at 100° F. This is important because it shows that the gasoline can be shipped in tank cars.

Some tests were made in which the natural gas was simply passed into naphtha of about 55° Baumé. When the naphtha had absorbed all the gasoline that was desired it was removed and fresh naphtha substituted. By this scheme there was obtained yields of gasoline varying between 300 and 500 per cent greater than that by the oil absorption and distillation process. In some cases the naphtha, besides being increased in volume due to the absorbed gasoline, was raised in specific gravity to 60° or 62° Baumé. An objection to the process lies in the fact that a large amount of naphtha has to be handled; at least 7 tanks of naphtha for each tank of gasoline obtained.

There are possibilities in the application of the absorption method of treating natural gas to the casing head natural gas, much of which is treated at the present time by compression and condensation methods.

The authors of this report are much indebted to C. F. Ward and A. M. Ballard, engineers of the Ohio Fuel Supply Company who rendered valuable aid during the entire experiments.

DISCUSSION:

MR. GEORGE A. BURRELL: Mr. President and Members of the Natural Gas Association of America, when I think of this very long paper and your patient auditors I am reminded of a story about a very long-winded preacher. At the conclusion of a particularly long sermon one Sunday he asked one of his flock what he thought about the sermon. The fellow said he thought "it was pretty good." "Well," the preacher said, "do you think I overlooked anything?" "Yes," the fellow said, "you did." "What was it?" asked the preacher; and the fellow replied, "Several fine places to stop." (Laughter). So I would like to ask permission of the President to comment briefly on the facts in the body of the paper and simply read the conclusions. Many of you who are particularly interested in the subject have read the paper as found in the printed volume now in the hands of the members, and I believe that will be sufficient.

I might say something about the facts that led up to our work on the process. I mentioned to Mr. S. S. Wyer one day that I would like to learn something about the method of obtaining gasoline from natural gas by absorption and he said that The Ohio Fuel Supply Company had already started on it and he thought it could be arranged, which it was. The work here represents several months' of experimentations and it is entirely through the good offices of The Ohio Fuel Supply Company that this data is presented.

We have been able only, in this paper, as long as it is, to simply hit the "high spots" of our experiments. Several hundred tests were made. Since this paper was written a good deal of work has been done, certain conclusions strengthened and some of them modified, and other work which we had in view at that time has been completed.

The process, as you know, is essentially different from the compression and condensation methods that have been used for a number of years now on casing head gases, on rich gases or so-called "wet" gases. I myself am not familiar with any compression and condensing plant that operates on casing head gas that contains less or yields less than three-quarters of a gallon of gasoline per thousand cubic feet of gas. Some of you may be familiar with plants that work on "leaner" gases, however, but that is the exception. Hence, the compression and condensing method was limited to a comparatively small amount of natural gas. In 1914 I think 17,000,000,000 gallons of casing head gasoline were produced — or, 17,000,000,000 cubic feet of natural gas were used and 42,000,000 gallons of gasoline produced by the compression and condensing method. That represented an increase over the year 1913 of about 14,000,000 gallons: Those are figures compiled by the United States Geological Survey.

One would have been considered a rash prophet indeed who would have predicted in 1911, when the quantity of gasoline produced was about 7,000,000 gallons, that the quantity in 1916 would approach close to 100,000,000 gallons. So I make that statement as a prelude to the statement on page four of the printed volume where the prediction is made that probably 75,000,000 gallons of gasoline can be produced by treating these leaner gases for gasoline by the absorption method.

The scheme in its simplicity is this: Natural gas preferably at high pressure is brought in contact with a heavy oil, say a petroleum distillate of about 35° Baume gravity that starts to boil about 375° to 400° Fahrenheit. In suitable absorbers the oil and the gas are brought in contact with each other. There the gas is stripped of its gasoline and then goes on its way to cities and other places for consumption. The oil with its charge of gasoline is pumped to a steam still where the gasoline is distilled out. The hot oil freed of its charge of gasoline is then cooled and sent back to the absorbers to receive another charge of gasoline. The process is continuous in that the oil is used over and over again with but slight loss. The main requirements of the oil are, first, that its boiling point be considerably higher than the boiling point of the gasoline so that a separation by fractional distillation can be easily made; and, secondly, that it be mobile enough and free flowing enough to pass easily through the system. I think in general the heavier oils are the better solvents of the gasoline.

I want to call attention to one or two errors that have crept into the manuscript. At the base of page one, "The average yield of gasoline was 2.43 gallons per cubic feet." It ought to be, of course, 1,000 cubic feet instead of cubic feet. That refers to the yield of gasoline obtained from casing head gas by compression and condensing methods in 1914.

The foot note on page 17, at the bottom of the table, "Refrigerator gasoline," means that obtained by condensing vapors escaping from the still and *not* condensed by the water in the condenser.

I would like to emphasize the fact that the natural gas after being treated for gasoline by this method is very little affected. Of two natural gases which we experimented with, one lost 3.8 per cent of its heating value after having been freed of its gasoline. Another one lost 24 b. t. u. or 2.2 per cent of its heating value. The heating value dropped off in the case of one gas from 1155 b. t. u. to 1111. In the case of another gas it dropped from 1111 b. t. u. to 1087. The amount of gas or vapor that disappeared due to its conversion into gasoline is small. I say here (page 20) a maximum of 8 cubic feet per thousand. I want to amend that to a maximum of about 16 cubic feet per thousand — probably 8 to 16 cubic feet.

I want to call your attention to the stability of the product produced. The oil absorbs not only gasoline but some of the lighter vapors of the natural gas. However, when the gasoline is steamed out of the oil those lighter vapors escape, some of which can be treated by compression and condensing methods, and a "wild" gasoline very similar to casing head gasoline produced, but the main body of the product as we found it varies between 77 and 85° Baume gravity. The boiling points ranged from about 80° F. to about 300° F. In other words, a very high grade gasoline indeed. The vapor pressure is not excessive. The highest I have recorded here is 4¾ points at 100° Fahrenheit.

Pressure has considerable to do with the yield obtained. You will note on page 25 that the yield varied from $^{7}/_{10}$ of a pint of gasoline per 1,000 cubic feet to 1.97 pints when the pressure was raised from atmospheric to 110 pounds per square inch.

We obtained the pressure of the gas at the street compression station and found it to be 235 pounds per square inch approximately, and of course it was economical to use that pressure; however, a pressure of 110 pounds would have obtained just as much gasoline as the higher pressure. You will note a considerable increase however from atmospheric pressure to 20 pounds guage, almost 100 per cent. In other words, as low a pressure as 20 to 25 pounds gives fair results.

We tried a number of different absorbers and found a counter current method, — a vertical tower in which the oil flowed down the tower and the gas up, the best; and I think this counter current method has been found to be the best in gas absorption methods by a great many technologists who have worked on these methods.

I have included the patents — all of those we could find on the subject, except one which I would like to read and have included in the minutes. This is a patent issued to Dennis Hastings and Andrew W. Brink, of New Martinsville, West Virginia, filed December 10, 1906, and patented October 1, 1907.

"This invention relates to apparatus for cooling compressed gas and separating gasoline and other light liquid, hydro-carbons from natural gas at the compressing station or at the well."

"We claim—In apparatus for removing gasoline from gas under compression, a reservoir constructed to contain a cooling fluid, a plurality of headers arranged in a reservoir, cooling pipes connecting the headers, expansion chambers connected in the pipes and of greater diameter than said pipes, means for discharging the liquid condensed in said chambers, and water spraying tubes arranged centrally of the pipes and provided with perforations for directing jets of water transversely across the pipes in the path of the streams of gas."

In the body of this patent these gentlemen say, "If water is used, the gasoline separates therefrom by gravity and can be readily drawn off into a storage tank. The oil is used, or fluilds other than water, such fluid, when gathered into the collecting tank, with the gasoline, can be used over and over by connecting the lower portion of the tank to the section side of the force pump 23."

From our invesigation into the matter we find that the first patents covering this process were taken out by Mr. Saybolt and applied for in 1906 and issued in 1911, and the first installation for extracting gasoline from natural gas by this process was placed at Hastings, West Virginia, by the Hope Natural Gas Company of Pittsburgh, Pennsylvania, and put in operation in 1913 as a result of the Saybolt experiments. The patent is broad and covers the methods of extracting naptha from natural gas.

Now I would like to read the summary in conclusion:

"The absorption method of extracting gasoline from natural gas consists of bringing natural gas in contact with an oil heavier than gasoline, i. e., a petroleum distillate of about 34° Baume, letting the absorbent absorb the gasoline from the natural gas, and then separating the gasoline from the oil by distillation. The oil is simply used as a carrier of the gasoline from the absorption tank to the still. It is used over and over again. This method is different from the extraction of gasoline from casing head natural gases by compression and condensation methods. By the latter method natural gases that are comparatively rich in gasoline vapor are treated, i. e., those usually carrying upwards from three-fourths gallons of gasoline per 1,000 cubic feet of natural gas. So-called "dry" natural gas cannot be treated by this method. By "dry" natural gases are meant those used in cities, towns and factories for heating, lighting or other purposes. The quantity consumed of this kind of natural gas amounted in 1914 to 591 billion cubic feet. Most of this natural gas carries gasoline to the extent of one to two pints per 1,000 cubic feet of gas. Probably 75,000,000 gallons of gasoline per year can be obtained by treating much of this natural gas at the present time.

"In the case of two natural gases that the authors of this paper experimented with, the heating value was only lowered 3.8

per cent in one case and 2.2 per cent in another case by the extraction of gasoline. The amount of natural gas that disappears varies from 4 to 16 cubic feet of gas per 1,000 cubic feet of gas.

"Besides the obtaining of valuable fuel, gasoline, a further advantage of the process lies in the resultant protection of pipe lines against the deteriorating effect of gasoline on coupling rubbers. The replacing of these rubbers and the repairing of broken connections and loss of natural gas thereby has been a large item of expense in gas transportation companies' operating costs.

"The absorption process of extracting gasoline from natural gas assumed industrial importance as the demand for gasoline increased. The scheme is practically identical with the process of extracting benzole and toluol (light oil) from coke oven gases, a process used for years in Germany and to a very large extent during the years 1915 and 1916 in the United States. A difference lies in the fact that coke oven gases are treated at about atmospheric pressure, while natural gas is treated at pressures as high as 200 to 300 pounds per square inch. This is an economic necessity because natural gas is transported at high pressure and it is not desirable to disturb the system.

"To the best of the authors' knowledge, the first large scale installation of extracting gasoline from natural gas by the absorption process was placed at Hastings, West Virginia, by Hope Natural Gas Company of Pittsburgh, Pa. Operations commenced in 1913. The plant was built following experiments by George M. Saybolt, of that company.

"Natural gas can be tested as regards the practicability of extracting gasoline from it by the absorption process by two methods. One is a laboratory method, whereby the gasoline is frozen out of the natural gas and its pressure and volume determined." I might say I did not include that method in this article. It was one of many things we cut out to shorten the article. "The other method is a field method.

"A small absorber and a gas meter can be taken to the well or pipe line to be tested for natural gas, the gas passed through the absorbent and the extracted gasoline distilled from the oil. In other words, a duplicate on a small scale of the commercial method.

"All natural gases except those that contain methane only as the combustible gas contain gasoline vapor. However, in some cases the amount contained may be very small. This is sometimes due to the fact that gas wells are under very high pressures and this high pressure keeps the gasoline back in the well. But even those high pressure wells represent potential sources of gasoline supply in that natural gas will carry commercial quantities of gasoline vapor as the pressure declines.

"Natural gas from two different fields that the authors tested contained gasoline to the extent of one pint per 1,000 cubic feet in one case and 1.5 pints in another case." Since this was written those yields have been exceeded. "About 50,000,000 cubic feet of natural gas per day was available for treatment.

"Oils which the authors experimented with to act as absorbents for the gasoline were about 35° Baume gravity and started to boil at about 400° to 482° F." I mentioned before that they started to boil at about 375°—400° to 482° is correct. "They were petroleum distillates. It is necessary that their boiling point be much higher than the boiling point of the gasoline to make the extraction of the latter by distillation easy.

"Tests were made on a plant of fairly large proportions, capable of handling 15,000 to 30,000 cubic feet of gas per hour. The plant consisted of an absorber where the natural gas and absorbent oil were brought in contact with each other, a heat exchanger where the oil with its absorbed gasoline were heated before going to the still; a steam still where gasoline was extracted from the oil; a cooler where the hot oil from the still was cooled before receiving another charge of gasoline; pumps, weathering tank, etc.

"Several different types of absorbers were tried. The one giving the best result consisted of a stone tower down which the oil flowed and up which the gas passed.

"An increase in the temperature of the oil in the absorber from about 75° F. to about 85° F. lowered the gasoline yield about .3 pints per thousand cubic feet of gas. An increase in the pressure of the gas from atmospheric pressure to 110 lbs. per square inch increased the yield from .7 pints to about 2 pints of gasoline per 1,000 cubic feet of gas.

"The specific gravity of the gasoline obtained varied between 77° Baume and 85° Baume. The boiling points ranged from 80° F. to 300° F. The evaporation loss was about 11 per cent in 24 hours as compared to straight refinery gasoline 60.4° Baume, having an evaporation loss of about 2.4 per cent in 24 hours. The vapor pressure of the gasoline ranged from one pound at 70° F. to about five pounds at 100° F. This is important because it shows that the gasoline can be shipped in tank cars.

"Some tests were made in which the natural gas was simply passed into naphtha of about 55° Baume. When the naphtha had absorbed all the gasoline that was desired it was removed and fresh naphtha substituted. By this scheme there was obtained yields of gasoline varying between 300 and 500 per cent greater than that by the oil absorption and distillation process. In some cases the naphtha, besides being increased in volume due to the absorbed gasoline, was raised in specific gravity to 60° to 62° Baume. An objection to the process lies in the fact that a large amount of naphtha has to be handled; at least 7 tanks of naphtha for each tank of gasoline obtained.

"There are possibilities in the application of the absorption method of treating natural gas to the casing head natural gas, much of which is treated at the present time by compression and condensation methods.

"The authors of this report are much indebted to C. F. Ward and A. M. Ballard, engineers of the Ohio Fuel Supply Company, and others who rendered valuable aid during the entire experiments."

I want to say as regards the application of the process of casing head gases, those gases that are at present treated by compression and condensation methods, that Mr. Biddison has obtained some very valuable data only recently and I am sure he would be glad to talk on that phase of the matter. I thank you (applause).

President Cartwright: Gentlemen, it would appear by the introduction of this absorption method that possibly the very grave situation that has arisen in the automobile industry might at least be forestalled. I do not know any more important matter that this natural gas industry has to face than that of securing an adequate supply of gasoline for commercial purposes. There is an old eastern adage that runs something like this, that "He who makes two blades of grass grow where only one grew before is greater than he that buildeth an empire." If these gentlemen and other scientists can point out a way whereby we can extract millions of gallons of gasoline where we did not extract any before, especially when gasoline is selling from twenty to thirty cents a gallon — I don't know what we should give them. They ought to have a crown of some kind. It opens up an entirely new field, and in a way, simply produces something from nothing. We did not get this before. It is not only a most useful, but a most important and revolutionary development. We do not reduce the heat value of the gas, and it seems to me that all the way around it is the most important proposition that the gas men have confronting them.

I notice that Mr. Reed, of the Hope Natural Gas Company, is present. He has had a very wide experience in the gasoline absorption process. I would like to hear from him, on this matter.

Mr. Charles C. Reed: Mr. President, I would like to ask Mr. Burrell what is the specific gravity of the gasoline obtained, and also the trade name for the oil of 34° gravity.

Mr. G. A. Burrell: Out of two different natural gases that were available for treatment at the street station the specific gravity of one of them was .68 (air equalling 1) and the specific gravity of another one was .63. After treatment in the gasoline plant the gravity varied, dropping in one case from .68 to .65, and in the other case from .63 to .61.

The trade name of the two petroleum distillates we tried are straw oil and mineral seal oil. We also tried some coal tar distillates and other oils.

President Cartwright: Are there any further remarks on this subject?

Mr. Erle E. Wagner: Mr. President, if I may make a suggestion, in talking about the extraction of gasoline from natural gas, I think that emphasis should always be placed on the fact that the heat value of the natural gas is not decreased to any appreciable extent, — for I know the newspaper men, and it will undoubtedly be given publicity and it would be rather serious if the people should think that interference with or decreases the heat value of their gas.

President Cartwright: That is brought out very clearly in the paper by Mr. Biddison and Mr. Burrell, that it does not materially decrease the heating value of the gas.

Mr. J. C. McDowell: Mr. President, I think another point that ought to be emphasized and has to be determined is that not every character and every kind of gas will produce this result. I can say from practical experience that it will not.

President Cartwright: I think you have made some experiments, have you not?

Mr. J. C. McDowell: Many of them.

Mr. Edward D. Leland: Mr. President, I would like to ask Mr. Burrell a question. I notice that he says from 8 to 15 cubic feet of gas disappear from each 1,000 feet of gas put through this method. Does he arrive at those figures by measuring the gas or does he arrive at them from calculation?

Mr. G. A. Burrell: I would like to have Mr. Biddison talk about that.

Mr. P. M. Biddison: Mr. President, in all of our experimental work we measured the inlet gases only; we took no measurement of the outlet gases because the percentage of gas lost in the absorption process was so small that measuring devices are not accurate enough to detect the difference in volume and the figures given in this report as to the amount of gas lost by the absorption of the gasoline constituents are arrived at by calculation from the known volumes of the vapors of the condensate.

In regard to the loss in heating value I would like to call attention to the fact that the figures given in this report of the b. t. u. loss are somewhat in excess of those that will be actually obtained in an operating plant. In an experimental plant none of the vapors which would not condense as they came from the still were ever put back into the residue gas. In a large scale plant the vapors from the weathering tank that do not condense in the condenser can be repressed to main line pressure and a high grade product derived from them, and this residue gas, which has a very high heating value, put back into the main line. If this had been done in the experimental plant on which we operated, the figures given for heating value lost, in this report, would have been lowered.

President Cartwright: I would like to ask Mr. Burrell if it is not a fact that in this absorption method, following out what Mr. Biddison has just said, it would be rather difficult to find that there has been any loss in the heating value of the gas?

Mr. G. A. Burrell: I think, Mr. President, for all practical purposes you can say, none, it is so small.

Mr. A. J. Diescher: Mr. President and Gentlemen, the figures of loss of heat value of gas as given in the paper correspond very closely with our own results in our plants, so that we have come to the conclusion that a limit of two per cent in the shrinkage of gas and about two per cent in the heat values is what we find in making about one pint of gasoline per 1,000 feet. Now, in the western country we have a gas that is high in nitrogen and also high in napthaline, and sometimes we get this gas associated or in contact with oil. Such gas would have a larger loss of heat value on account of taking some quality out that would leave the percentage of nitrogen slightly higher.

PRESIDENT CARTWRIGHT: Mr. Parks, what has been your experience in loss of heat value, in the southern West Virginia field?

MR. R. N. PARKS: Mr. President, from information received — our plants are just building, but I find in talking with other engineers and Mr. Reed, in particular, that they made a week's run and found only a loss of one-third of one per cent.

PRESIDENT CARTWRIGHT: One-third of one per cent in West Virginia gas?

MR. R. N. PARKS: Yes.

MR. ISAAC N. KNAPP: Mr. President, he speaks in one place of a stone tower. Does he mean just filling the tower with stone, in place of wood slats?

MR. G. A. BURRELL: The particular tower we had reference to was filled with stones of about fist size, picked up in the bed of a creek close to the plant.

MR. P. M. BIDDISON: It is shown on page 16.

PRESIDENT CARTWRIGHT: We will be glad to hear from any other member.

MR. CHARLES C. REED: Mr. President, I would like to say, in addition to what Mr. Parks has said as to our loss of heat value, that these tests were made along in March when there was not a lot of cooling water available and our temperatures in general were rather warm. The yield per million was about 80. They were made with a Junker's calorimeter, first on the inlet and then on the outlet. The Junker calorimeter only has an accuracy of 99½ per cent; so that in averaging the week's run we found that our loss was only one-third of one per cent. In addition, that loss included the old vent gas which was not put back into the line but was put into the boilers. The gravity of the gas was along about 65; the heat value about 1,000 net.

President Cartwright: Can we hear from Mr. Oberfell?

Mr. G. G. Oberfell: Mr. President, I do not know of anything that I can add to the paper. It has been pretty well taken up and discussed. My work consisted mostly of the chemical analyses.

One gentleman spoke of a large percentage of nitrogen in the gas. Some of the work has shown that some gases contain about as high as 35 per cent of nitrogen and if drawn from a low field it will give a high percentage of gasoline, some times as high as two and a half pints or better, and some times as high as three pints.

President Cartwright: Any further remarks?

Mr. W. F. Schell: Mr. President, as a matter of information I would like to ask a few questions that are normally asked by persons who are interested — by normal men, lots of times, who are interested in these propositions. About the first thing they ask is, "How much is this going to cost?" "Has there been any definite rule laid down for the cost per million, or per 10 million, or per fifteen million in handling for the installation of a plant like this, or the operating cost of it?"

Another question that some times is asked is, "How much water will be required for operating this plant for cooling purposes and so on" and "How much area will be required for the installation of the plant?" "How much ground will be required?" Has there been any definite 'dope' brought out or any rules that cover anything like that? That is often times asked by men who are thinking of installing propositions of this kind.

Mr. G. A. Burrell: I think Mr. Biddison can give you all that information.

Mr. P. M. Biddison: Mr. President, in regard to cost per million feet capacity, we have given in this report an estimate based on, largely, pure guesswork at that time. At the time this report was made up the writers had not designed a working plant. Several plants are in the course of construction now. But if anybody can estimate at the present time what anything is going to cost, they can do more than I can do (Laughter and applause).

The matter of cooling water required and the steam consumption is really a matter of refinery design. Data on that is hard to find. I have had a great deal of difficulty myself in finding literature on that subject. But those who are interested in these details of design can circulate about among their friends who are building plants and probably pick up enough information.

President Cartwright: While on your feet, Mr. Biddison, will you again go into the matter of the question of the depreciation in the heat values of the gas? I did not quite follow your statement before. What has been your experience on that?

Mr. P. M. Biddison: We have made tests on both the inlet and the outlet gases, from our experimental absorption plant. The calorimeteric tests on these gases were made by the Bureau of Mines at the Pittsburgh Laboratory. The results of some of those tests are shown in this report. But I want particularly to call your attention to the fact that while the loss in heating value as shown in this report is low, the reduction in heating value in a large sized plant will be materially lower yet than this, because after the extraction of the gasoline you have left, at low pressures, some non-condensible vapors coming from the condensor and from the weathering tank which have a very high heating value, largely butenes. Those gases are recompressed and returned to the main line where they are remixed with the bulk of your gas. By returning to your residue gas from the absorption plant a fraction of very high heating value gas, you will raise its heating value to practically the same figure as it had before the gas was treated. So that the extraction of the gasoline constituents will make such a small reduction in heating value of the gas that the reduction will hardly be measureable by the apparatus which we have available for such work.

Mr. R. S. Lord: Mr. President, just in line with what Mr. Biddison has said, and before we are done, I would like to call attention to the fact that Mr. Burrell mentioned that Mr. Biddison had something more up his sleeve on the subject of casing head gas which I think we ought to hear. But in the matter of putting back into the line this element of very volatile gas which can not be compressed, it is my understanding and I think that Mr. Biddison will agree with me, that this does not in any way endanger the rubber that has been spoken of in the paper; is that true?

Mr. P. M. Biddison: That is correct.

Mr. R. S. Lord: The lower gravity gasoline would be the one, I suppose, that would cause trouble in the line; and I believe that one very important consideration of this subject is besides getting money out of the thing we will be getting another blessing out of it, as Mr. Burrell has mentioned — the pipe line troubles will be to a very great extent entirely eradicated and some of the problems not yet entirely solved, in the matter of welding pipe line, may possibly be worked out a little more in detail and at leisure, if the gasoline is taken out. The pressure that can be handled on the rubber jointed line you all know very well. We have had a little bit of experience in this city last winter. The two lines constructed on the new Bloomfield bridge in Pittsburgh a year ago by the city, upon which I had charge of the construction work, froze up this last winter — the water lines. A pipe three-eights inch thick, sixteen inch i. d. pipe, burst under the pressure of freezing. The engineers of the National Tube Company who investigated the case found what the cause of the trouble was. It took something like two thousand pounds' pressure to burst those pipes in the condition they were in. They were burst open so that they stood open six inches in some places. But the line was put together again without any change in the work — without any change in the couplings whatever and the line is tight. Now this gasoline feature being eradicated will save a whole lot of trouble in pipe line work. But we would like to hear from Mr. Biddison particularly in regard to what Mr. Burrell mentioned.

Mr. P. M. Biddison: Mr. President, Mr. Lord's reference to the freezing of pipe lines brings up another interesting point in regard to the absorption process, and that is that the absorption process of taking gasoline from natural gas is in reality merely the recovering of a product which we are daily wasting, blowing out through our main line drips. It is a condensate which as a general thing will not condense at the compressing stations completely, because we are unable to bring down the temperature of our gas to a sufficient point to complete the condensation, but in the colder winter months when the ground is frozen and the temperature of flowing streams is close to the freezing point a great deal of this material condenses in the pipe lines and is blown out. The absorption process collects all of this product which you have been daily wasting through your main line drips, at one central point and makes it available for marketing.

In regard to the application of this system to casing head gas problems, we have had in operation at a casing head plant in West Virginia an absorption plant, one of the plants which we used in the experimental work covered by this paper. We found at this plant, first, that by installing the absorption plant on the outlet from the compression system we were able to absorb a large amount of gasoline vapors from the residue gas, but with these gasoline vapors we also absorbed so large an amount of non-condensible vapors that we were unable to condense any part of the vapors absorbed. This plant was working at about 180 pounds delivery pressure. We then installed the absorption plant on the outlet side of the vacuum pump at about 2 pounds pressure and made runs at the various ratios of oil to gas to see if at a reasonable rate of oil circulation we could equal the gasoline yield given by the compression plant. But even by cutting down the amount of gas passed through the absorber and increasing the amount of oil passed up to the maximum capacity of the pumps which we had, we were unable to anywheres near approach the yield given by the compression method at this low pressure. We then connected up the absorption plant on the outlet from the low suction side of the compressors on the intermediate pressure line and made runs both before and after cooling the compressed gas.

At pressures of about 20 to 23 pounds gauge we were then able to equal the yield given by the compression methods. So that we now know that at pressures of slightly over 20 pounds the absorption method will give a yield equivalent to that given by the compression method.

It will make a cheaper installation than the compressor method, and the use of the absorption system on the casing head gasoline is dependent upon the pressures required to dispose of your residue gas. If the pressure at which you can dispose of your residue gas is high enough to condense the gasoline constituents, the absorption system has no application. If, however, you can dispose of your residue gas at comparatively low pressures, the absorption system can be combined with a low pressure compressor and a very economical installation made in that manner. Use can be made of the heat in the exhaust gases from the compression plant to furnish the steam for distillation in the absorption plant.

I have understood that some other parties have done some work along similar lines and have had better results than we had in working on the residue gases from the compression plant. If any of the gentlemen who have been working on that are here I should like very much to hear from them too.

Before I sit down I would like to call attention in the paper to one or two corrections that Mr. Burrell did not comment upon.

On page 20, at the bottom of the page, "Instead of decreasing the amount of oil, the practice of the authors was to keep the oil rate at about seven gallons and increase the gas rate." That "seven gallons," please correct that to four gallons.

At the top of page 21, "28,000 cubic feet of gas per hour" instead of "per minute;" and circulating about 4, instead of "about 7 to 8 gallons of oil."

On page 31, the first sentence, in referring to tests made with naptha as an absorbing medium, it should be 4.86 pints instead of "gallons;" and "the lowest yield was" 2.70 pints, instead of "gallons."

Mr. H. D. Hildebrand: Mr. President, I would like to ask Mr. Burrell, if he found any difference in the quality of the gasoline after passing through the absorbers than what he found originally in the plant? In other words, I want to ask if the gravity was the same and if the evaporation loss amounted to the same after the gasoline was made?

Mr. P. M. Biddison: In our tests of the absorption method in connection with the casing head gas proposition, we found that at about 20 to 25 pounds' pressure we could produce a gasoline of the same gravity and in the same amount as was being produced by the compression plants.

The product given by the absorption process showed a weathering loss under identical conditions with that given by the compression method of only about one-half. That is, the weathering loss on the absorption process gasoline was about half of that of the compression process gasoline — gasoline of the same gravity and obtaining the same yield per 1,000 cubic feet.

Mr. Thomas R. Weymouth: Mr. President, I would like to ask Mr. Biddison at this point your experience in removing water vapor from the gas and thus preventing it from getting into the main line?

Mr. P. M. Biddison: You ask me if it would remove the water contents from the gas?

Mr. Thomas R. Weymouth: Yes, where you have gas carrying a great deal of water, if the absorption method does not remove a great deal of water?

Mr. P. M. Biddison: It will probably remove free water, but whether it will remove the water vapors I do not know, we had no facilities for determining that.

Mr. J. C. McDowell: Mr. President, the writers of the paper stated that this process of passing gases through a menstrum of oil of other fluids is very old and has been used in Germany and elsewhere for a great many years. It may be interesting for the members of this association to know that the Southern Ontario Gas Company, producing gas in the Tillbury Field having a sulphur contents of about two and a half per cent, making it disagreeable to use for domestic purposes, and to overcome this difficulty Mr. Henry L. Doherty invented a method adopting the principle of this old and well known principle, for the removal of this sulphur, by passing the gases through — this vile gas, much like the Trenton rock gas of a few years ago with which you were all acquainted — passing it through ammonia and then heating the ammonia and recovering the sulphur, removing practically everything excepting a trace; and at that plant today we are passing about 8 million feet per day and practically purifying it all.

President Cartwright: Do you recover any by-products?

Mr. J. C. McDowell: We can recover the sulphur, in the shape of flour of sulphur, sufficient to warrant us in doing it, and it is by a very simple process, a very simple apparatus, much more simple than the one that has been described here.

President Cartwright: Any further remarks, gentlemen? If not, the Chair will be glad to entertain a motion of thanks.

Mr. John M. Garard: Mr. President, I move you that a vote of thanks be tendered to the writers of this most excellent paper, and also to the various members present who have so ably discussed it.

Secretary Jones: I second the motion.

Mr. George A. Burrell: Mr. President, I would like to have you include in that vote of thanks, the Ohio Fuel Supply Company also for their very valuable assistance in this work.

Mr. John M. Garard: I will be very glad to accept the amendment.

The above motion as amended, having been duly seconded, was then unanimously adopted.

President Cartwright: I will ask Mr. Garard to take the Chair.

After assuming the President's chair, Mr. John M. Garard said: Gentlemen, we will be glad now to hear from the Committee on President's Address. Mr. Daly, I believe, is chairman of that committee. If he is not here, as I recall Mr. McDowell is also a member of that committee and I will call upon him to read the report.

Mr. J. C. McDowell: Mr. Daly is not present I think, at this time, but he left me a copy of the report.

And thereupon Mr. J. C. McDowell submitted and read the following:

REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS.

PITTSBURGH, PA., May 18, 1916.

To the Members of the Natural Gas Association of America:

Your committee has considered the President's address and begs to submit report, as follows:

The review of the work accomplished during the past year, the greater organization recommended for the future, and the evidence of careful thought given the work in connection with the energy and devotion of the retiring officers makes this paper well worthy of perusal and must impress all who have heard, or who will read it, with the dignity of the business in which we are engaged, and inspire greater effort on the part of each individual to render better service to the public which we serve.

We recommend the acceptance by the Association of the report as it stands.

Respectfully submitted,
M. B. DALY, *Chairman,*
J. C. McDOWELL,
A. HURLBURT.

ACTING PRESIDENT GARARD: Gentlemen, you have heard the report of the Committee on the President's Address. What are your wishes?

MR. J. F. GRAY: Mr. President, I move that the report be accepted and placed on file.

The above motion, having been duly seconded, was unanimously adopted.

ACTING PRESIDENT GARARD: Gentlemen, I move you, on account of the modesty of our retiring president, that we extend to him a vote of thanks for his untiring efforts in behalf of the Association during the past year. I know he has devoted a great deal of his valuable time to the work of this Association; knowing as I do the amount of time and labor he has expended in your behalf, I want to tell you about it and I hope that each and every one of you will show your appreciation by tendering him a hearty vote of thanks, your approval of this motion being evidenced by rising to your feet.

The above motion was then duly seconded and unanimously adopted, amid applause, by a rising vote.

Acting President Garard: Gentlemen, I thank you very much.

President Cartwright, resuming the chair, then said: We will now have the report of the Committee on Next Place of Meeting. Mr. Raymond Cross, I believe, is chairman of the committee and I will call upon him for the report of the committee.

Mr. Raymond Cross then submitted the following:

REPORT OF COMMITTEE ON NEXT PLACE OF MEETING.

Pittsburgh, Pa., May 18, 1916.

Mr. President, and Members of the Natural Gas Association of America:

Your committee on convention for 1917 has met, and beg to submit the following:

A strong invitation has been extended for next year's convention by both Tulsa, Oklahoma, and Buffalo, N. Y., which has necessitated our consulting various members from both East and West. Considering the fact that 1915 and 1916 conventions have been held in the East, we feel somewhat reluctant about recommending that the East be again favored in 1917, but we are reliably informed that Tulsa will be much better prepared to entertain our membership in 1918, and after due consideration, respectfully recommend that the invitation of Buffalo, N. Y., for 1917 convention be accepted.

Respectfully submitted,

Raymond Cross,
Arthur Booth,
J. R. Munce,
Committee.

Mr. B. C. Oliphant: M. President, I would like to make a motion — coming from Buffalo — that the Natural Gas Association of America hold its next annual meeting at the City of Buffalo, New York, and it goes without saying that we will do all in our power to make it as successful a meeting as this one has proved to be.

Mr. J. C. McDowell: Mr. President, as a member of this Association, connected with gas companies in that immediate vicinity, I take great pleasure in seconding the motion.

President Cartwright: Gentlemen, I feel as the members of the committee do, that the West is certainly entitled to the next meeting of our Association, but after discussing it thoroughly with a number of Western men, it seemed to be the concensus of opinion that probably 1918 would be a better year than 1917 for the Association to go West. So, while this meeting can not go on record as fixing the place of meeting for 1918 at Tulsa, Oklahoma, yet I think that we can all feel assured that it will have it two years hence, and I hope at that time we will have the biggest convention we have ever had. Gentlemen, you have heard the report of the committee; what shall be done with it? You have also heard the motion of Mr. Oliphant, duly seconded by Mr. McDowell.

Mr. John M. Garard: I move that the recommendation of the committee, contained in its report, that the next meeting of the Natural Gas Association of America, be held at Buffalo, New York, be accepted and approved.

Each of the above motions, having been duly seconded, was unanimously adopted.

President Cartwright: That being the case, the next regular meeting of the Natural Gas Association of America will be held at Buffalo, New York, the third Tuesday of May, 1917.

Mr. M. B. Carmody: Mr. President, on behalf of the South-western and Southern members of the Association, I would like to say that it would be a great accommodation to them if you could put the convention forward a few days beyond the 15th of the month. The summer rates on the railways to all points North of St. Louis commence on the 15th day of May. By so doing, it would relieve us of considerable expense as far as railroad transportation is concerned. Therefore, if it is not obligatory on the Association by reason of its laws, we would be glad if you would consider putting the time of meeting forward two or three days or a week, so that we can reap the benefit of these summer rates.

PRESIDENT CARTWRIGHT: The directors have that power, and I would be very glad indeed to bring it before them at their next meeting.

MR. JOHN J. NASH: Buffalo is too far North. (Laughter).

PRESIDENT CARTWRIGHT: The later we hold the meeting the better weather we will have. They have been trying to tell me that the flowers are all out now in and around the city of Buffalo. On the other hand, I have heard that there was still ice coming down the Lake. Your suggestion will receive consideration also, Mr. Nash. (Renewed laughter).

We will now have the report of that all important committee of Ways and Means for increasing the Scope, Usefulness and Efficiency of the Natural Gas Association of America, and of which Mr. Garard is chairman.

MR. JOHN M. GARARD: Mr. President and Gentlemen; probably I better make a little explanation in regard to this committee. At a meeting of the Board of Directors and the Committee, it was decided that something should be done to increase our membership and to enlarge the scope of the Association. To that end our Honorable President appointed myself, Mr. Daly and Mr. Gill to submit a report at this meeting. It would require a great deal of time — much more than we have — to get in touch with all the various gas companies in the gas producing states, and it is necessary that we know something about all of them before we can accomplish our purpose. I do not mean by that that we want to continue this committee, but the committee that does act will have to have the necessary time. We have accomplished but little. But your committee, having given this important subject such attention as it could, has prepared and is ready to submit its report.

Mr. John M. Garard then submitted the following:

REPORT OF WAYS AND MEANS COMMITTEE.

PITTSBURGH, PA., May 18, 1916.

To the President and the Members of the Natural Gas Association of America:

Gentlemen:—Your Ways and Means Committee begs to suggest: That the members of this Association give approval to the proposal to establish a permanent General Headquarters, continuously devoted to the best interests of the Natural Gas Industry, and that the Ways and Means Committee be authorized to equitably classify and assess the various companies identified with this Association to the end that the necessary funds may be promptly provided and that the incoming President be empowered to appoint a permanent Commercial Secretary.

J. M. GARARD, *Chairman*,
M. B. DALY,
JNO. E. GILL.

PRESIDENT CARTWRIGHT: Gentlemen, you have heard the report of the Committee on Ways and Means. I would urge that some favorable action be taken upon it. I can not agree with Mr. Garard that the committee has done but little work. In fact I know that they have done a great deal of work. They have held a number of meetings and this seems to be the best solution of this very knotty problem. It leaves it in shape for the directors and advisory committee, in conjunction with this committee, to formulate a detailed plan whereby the desired end can be reached. I would be glad to entertain a motion in connection with this report.

MR. H. J. HOOVER: Mr. President, I move the adoption of the committee's report, without any changes.

MR. SAMUEL S. WYER: I second the motion.

The above motion, having been duly seconded, was then unanimously adopted.

PRESIDENT CARTWRIGHT: The next order of business will be the report of the Committee on Nomination for officers for the ensuing year. Mr. Lynn, I believe, is chairman of that committee. Will Mr. Lynn please come forward?

Mr. James T. Lynn, who was then assisted to the rostrum by three or four members of the Association amid much laughter and applause, said: Boys, I am not as lively as I was last night. (More laughter and applause). The following was then submitted:

REPORT OF COMMITTEE ON NOMINATIONS.

PITTSBURGH, PA., May 18, 1916.

To the President and Members of the Natural Gas Association of America:

GENTLEMEN: Your Nominating Committee begs to submit the following report:

For President: Jos. F. Guffey, Pittsburgh, Pa.

For Vice President: Glen T. Braden, Tulsa, Oklahoma.

For Secretary & Treasurer: T. C. Jones, Delaware, Ohio.

For Directors:

Arthur Booth, Pittsburgh, Pa.
F. P. Grosscup, Charleston, W. Va.
B. C. Oliphant, Buffalo, N. Y.
J. C. Duffield, London, Ontario.
Alfred Hurlburt, Kansas City, Mo.
O. K. Shannon, Ft. Worth, Texas.

For Editor Wrinkle Department: W. Re. Brown, Columbus, Ohio.

For Asst. Editor Wrinkle Department: Alfred J. Diescher, Bartlesville, Okla.

Respectfully submitted,

J. T. LYNN, *Chairman,*
O. K. SHANNON,
T. O. SULLIVAN.

The reading of the above names as nominees for the respective offices and positions above indicated was greeted by rounds of applause, after which, Mr. James T. Lynn said:

I want to state to the members of the Association that Mr.

Shannon was the only nominee for director who objected to his name going into the report of the committee, but the other two members of the committee absolutely refused to make a report unless he allowed his name to be incorporated therein, to represent the state of Texas.

With reference to the Wrinkle Department, there was another matter which the committee considered, although we did not know whether it was up to us to make a suggestion to the Association or not. However, with reference to that department, I may say that we would suggest that the chief editor of the Wrinkle Department or the incoming president, whichever may be decided upon, appoint an assistant editor in each state producing natural gas. I think that will help out the Wrinkle Department, which is a very important department especially to the small operator who is a member of this Association. I thank you.

PRESIDENT CARTWRIGHT: Gentlemen, you have heard the report of the Committee on Nominations. What is your pleasure?

ELECTION OF OFFICERS.

MR. J. J. KENNEDY: Mr. President, I move that the report of the Committee on Nominations be adopted as read and that the Secretary be authorized and directed to cast the ballot of all members present for the election to office of the members nominated for the respective offices as indicated by the report of the committee.

MR. JAMES T. LYNN: I would amend that motion by substituting the name of William Y. Cartwright, president, to cast the ballot of the members instead of the secretary whose modesty no doubt will prevent him from acting in that capacity, inasmuch as his name appears, as usual, in the report of the Committee on Nominations.

MR. GEORGE W. BARNES: Does that cover the supplemental report and recommendation as well as the report itself?

PRESIDENT CARTWRIGHT: Yes, we will assume that it covers each.

MR. GEORGE W. BARNES: I second the motion.

The above motion having been duly seconded, was then unanimously adopted.

PRESIDENT CARTWRIGHT: Gentlemen, it gives me great pleasure indeed to cast the ballot of each member of this Association for the election of the nominees to the various offices as referred to in the report of the Committee on Nominations, and I do now cast the ballot accordingly. I will appoint a committee consisting of Mr. Lynn, Mr. Garard and Mr. McDowell to find Mr. Guffey and bring him forward so that we may have a look at our new president.

The above committee then escorted forward the newly elected president of the Association, Mr. Joseph F. Guffey, amid rounds of applause, after which Mr. Guffey said:

SOME RESPONSES.

Fellow members of the Natural Gas Association of America: I desire to thank you sincerely for the honor conferred, and I assure you that I will devote my best efforts during the coming year to continue the Association in its present prosperous and successful condition. I ask of you as members of this Association to give me your best help and assistance. I may also frankly say to you now that I feel the need of such help and assistance and would be very glad indeed to receive your advice and criticism at all times. I again thank you for the honor conferred.

PRESIDENT CARTWRIGHT: We will now hear from Mr. Jones. (More applause).

SECRETARY JONES: Mr. President and Gentlemen, I certainly appreciate your renewal of favors, and I can only say I will continue to do my level best for the success of this organization. I thank you. (More applause).

MR. JOHN M. GARARD: That is the same old speech he has made for the last ten years. (Laughter and more applause).

A VOICE: Look on page 422 of the old record. (Renewed laughter).

The Secretary received the following letter from Vice President Braden after the meeting:

TULSA, OKLAHOMA, June 1, 1916.

MR. T. C. JONES, *Secretary, Natural Gas Association of America,*
Delaware, Ohio.

MY DEAR MR. JONES: — Your official notice of my election to the vice-presidency of the Natural Gas Association is received.

I feel very much pleased that the Association would again remember me in view of the fact that I was obliged to withdraw my name from the presidency two years ago.

The conditions at that time seemed to make it imperative, but now I sincerely hope that I will be able to take up the work of the vice-president of this Association and carry it through and succeed in being in some degree of benefit to the Association and the advancement of the good work which is being done.

I have made it a special point to attend the conventions during the past three years and I find a great deal to interest me. From my own experience I heartily recommend that all members of the Association take time to attend these annual conventions, as I am confident that in doing so they will be well paid.

I certainly congratulate the Association on the splendid progress they are making and the great benefit to the Natural Gas Industry throughout the country.

Very respectfully yours,
GLENN T. BRADEN.

PRESIDENT CARTWRIGHT: Gentlemen, the next order of business is the report of the Committee on Memorials, of which Mr. B. C. Oliphant is chairman.

Mr. B. C. Oliphant then submitted the following:

REPORT OF COMMITTEE ON MEMORIALS.

To the Members of the Natural Gas Association of America:

GENTLEMEN:

WHEREAS, Since the last meeting of this Association, an All-Wise Providence has seen fit to remove from our roll the name of one of our most esteemed members, Mr. George Heard of Pittsburgh, Pennsylvania, at the time of his demise President of The Natural Gas Company of West Virginia, and

WHEREAS, This Association desires to record its appreciation of the immense amount of work so willingly and conscientiously performed at any and all times by Mr. Heard in the interests of this Association and the gas industry generally, and

WHEREAS, Mr. Heard by his unfailing courtesy, uniform kindness and cheerful disposition, endeared himself to all with whom he came in contact, and therefore be it

Resolved, That this Association hereby express its deep regret at the loss sustained by the bereaved family and sympathizes with the relatives in their affliction, and be it further

Resolved, That as a token of our esteem and regard this preamble and resolution be spread upon our minutes, and that a copy be sent to the family of the deceased.

WHEREAS, The All-Wise has seen fit in His unerring judgment to take from us part of our life and hopes as an Association, and while recognizing His wisdom in all things, be it

Resolved, That we extend to the families of former members —

Mr. A. R. Gray, Chief Engineer, The East Ohio Gas Co., Cleveland, Ohio.
Mr. Chas. E. Rogers, Chief Engineer, Manufacturers' Light & Heat Co., Wheeling, W. Va.
Dr. Joseph A. Holmes, Director, United States Bureau of Mines, Washington, D. C.
Mr. J. J. Donovan, Assistant Chief Engineer, Manufacturers' Light & Heat Co., Wheeling, W. Va.
Mr. A. D. Chase, Chief Station Engineer, United Natural Gas Co., Wheeling, W. Va.
Mr. Wilbur S. Squire, Field Superintendent, Peoples' Fuel Supply Company, Newkirk, Oklahoma.
W. J. Patton, Purchasing Agent, Manufacturers' Light & Heat Company, Pittsburgh, Pennsylvania.

our sincere sympathy, and that as a mark of our high regard for the memory of the departed, this memorial shall be made a part of the permanent records of the Association.

Respectfully submitted,
B. C. OLIPHANT,
J. G. HANKS,
ALFRED J. DIESCHER.

Mr. J. H. Maxon: Mr. President, I move that the report of the Committee on Memorials be received, approved and ordered spread upon the minutes of this meeting.

Mr. J. C. McDowell: I second the motion.

President Cartwright: Gentlemen, in receiving and approving this report, I suggest that the vote be by a rising vote.

The above motion, having been duly seconded, was then unanimously adopted, by rising vote.

President Cartwright: The next order of business is the report of the Committee on Final Resolutions, of which Mr. R. G. Altizer is chairman.

Mr. R. G. Altizer: If I was chairman of that committee, this is the first notice I had of it.

President Cartwright: I will call on Mr. Walsh then to read the report of the Committee on Final Resolutions.

Mr. M. W. Walsh then read the following:

REPORT OF COMMITTEE ON FINAL RESOLUTIONS.

To the Members of the Natural Gas Association of America:

This convention could not possibly be complete without official recognition of those who have through their ability and aptness guided the Association on its course during the year that is closing with this final session.

We feel it our privilege as a committee appointed to draft final resolutions, to express in behalf of the Association heartfelt appreciation of that which has been accomplished through the Association's executive head, Mr. W. Y. Cartwright.

Various proposed features have come to the fore during the year 1916 that will undoubtedly be carried out to the decided advantage of the Association as a whole, and of its members severally.

In the planning and executing of the various moves that have thus far been placed in operation, both the President and his Directors should be extended a most hearty vote of thanks by the Association, in session.

The burdens of an Association's Secretary are seldom appreciated by the members of the Association. They are many and are complex, and we would direct most especial attention to the service that has been rendered the Association by its able Secretary, Mr. T. C. Jones.

To the Gas Interests of the City of Pittsburgh who have so splendidly stood sponsors for our meeting in their most interesting city, we feel warranted in stating that the Association to a man expresses unbounded appreciation for their considerate cooperation.

As our Association conventions have developed in numbers attending and in membership, so has the interest increased to a large extent. However, on account of the stupendous work done by The Supply Men's Section of this organization and the wonderfully complete and comprehensive exhibits that have been planned and carried out under the offices of the Supply Men's Association, we must agree that the exhibitions have done much to attract the attendance of members and have proven themselves direct means of educating the natural gas men of our country to a better understanding of the completeness and excellence of the appliances available for natural gas service and that are manufactured in the United States. For this reason, a universal expression of thorough appreciation should be, and is, extended to the Supply Men's Association by the members of the Natural Gas Association of America.

It would be impossible to in detail mention all of those to whom both honor and thanks are due; therefore, in closing we would collectively extend to all such an expression of appreciation and gratitude from the Association.

(Signed)
A. W. LEONARD,
M. W. WALSH,
R. G. ALTIZER.

PRESIDENT CARTWRIGHT: Gentlemen, you have heard the report of your Committee on Final Resolutions. What shall be done with it?

MR. JAMES T. LYNN: I move that the report be received, approved and spread upon the record.

MR. F. W. STONE: I second the motion.

The above motion, having been duly seconded, was then unanimously adopted.

MR. JOHN M. GARARD: Mr. President, I move you that a vote of thanks be tendered to Mr. David O. Holbrook and his associates for the very able manner in which they have conducted their part in so ably assisting in making this one of the most successful meetings we have ever held, and also thanking them for the entertainment that they have furnished to the members of the Natural Gas Association during the Pittsburgh meeting.

PRESIDENT CARTWRIGHT: Mr. Garard, that has already been done in the report of the Committee on Final Resolutions.

MR. JOHN M. GARARD: Maybe it is, but I want it done again. (Laughter and applause).

SECRETARY JONES: I second the motion.

PRESIDENT CARTWRIGHT: Gentlemen, it is moved and seconded that an additional vote of thanks be extended to Mr. Holbrook and to the members of the association of Natural Gas Supply Men for the valuable assistance and the splendid entertainment they have given us.

The above motion, having been duly seconded, was then unanimously adopted.

PRESIDENT CARTWRIGHT: Gentlemen, we are now ready to entertain a motion to adjourn.

MR. JAMES T. LYNN: I move we adjourn.

MR. J. C. MCDOWELL: I second the motion.

PRESIDENT CARTWRIGHT: Before putting this motion to a vote, I want to thank all of the members of this Association for the splendid manner in which they have assisted the executive officers of the Association throughout the year just ending. And also I desire to thank the membership for the generous manner in which they have attended this convention. We haven't had any convention where there has been as many present regularly at each session as at the sessions of this, our eleventh meeting.

Again thanking you one and all, and extending to each of you best wishes for the coming year, I will put the motion to adjourn.

And thereupon, on motion duly seconded and carried, the eleventh annual meeting of the Natural Gas Association of America adjourned sine die.

APPENDIX

OFFICERS

OF THE

NATURAL GAS ASSOCIATION OF AMERICA 1916-1917

President.

JOSEPH F. GUFFEY........................Pittsburgh, Pennsylvania

Vice President.

GLENN T. BRADEN..........................Tulsa, Oklahoma

Secretary and Treasurer.

THOMAS C. JONES...........................Delaware, Ohio

Directors.

JAMES B. CRAWFORD, Oil City, Pa.........	Term Expires 1917
JOHN R. MUNCE, Little Rock, Ark........	Term Expires 1917
KAY C. KRICK, Columbus, Ohio..........	Term Expires 1917
AUSTIN G. CURTIS, Shreveport, La........	Term Expires 1917
HARRY J. HOOVER, Cincinnati, Ohio.......	Term Expires 1917
VINCENT L. ELBERT, Saint Joseph, Mo.....	Term Expires 1917
BERT C. OLIPHANT, Buffalo, N. Y........	Term Expires 1918
ALFRED HURLBURT, Kansas City, Mo......	Term Expires 1918
JAMES C. DUFFIELD, London, Ontario.....	Term Expires 1918
ARTHUR BOOTH, Pittsburgh, Pa..........	Term Expires 1918
FRED P. GROSSCUP, Charleston, W. Va.....	Term Expires 1918
OGDEN K. SHANNON, Fort Worth, Texas..	Term Expires 1918

Past Presidents.

*KERR M. MITCHELL............................	1906–1907
JESSE C. McDOWELL...........................	1908–1909

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*Deceased.

William H. McKenzie	1910
John M. Garard	1911
Alexander B. Macbeth	1912
Martin B. Daly	1913
Ernest L. Brundrett	1914
James T. Lynn	1915
William Y. Cartwright	1916

Past Secretaries.

Joseph H. Dunkel	1906–1908
James F. Owens, (Elected for)	1909

Past Annual Meetings.

Organization, Kansas City, Mo., Feb'y. 20, Feb'y. 27 and March 20, 1906.

First	Kansas City, Mo., June 12 and 13, 1906
Second	Joplin, Mo., May 21, 22 and 23, 1907
Third	Kansas City, Mo., May 19, 20 and 21, 1908
Fourth	Columbus, Ohio, May 18, 19 and 20, 1909
Fifth	Oklahoma City, Okla., May 17, 18 and 19, 1910
Sixth	Pittsburgh, Pa., May 16, 17 and 18, 1911
Seventh	Kansas City, Mo., May 21, 22 and 23, 1912
Eighth	Cleveland, Ohio, May 20, 21 and 22, 1913
Ninth	Saint Louis, Mo., May 19, 20 and 21, 1914
Tenth	Cincinnati, Ohio, May 18, 19 and 20, 1915
Eleventh	Pittsburgh, Pa., May 16, 17 and 18, 1916

Resident Secretary.

David O. Holbrook .... Pittsburgh, Pennsylvania

Wrinkle Department.

W. Re. Brown, *Editor*	Columbus, Ohio
Alfred J. Diescher, *Assistant. Editor*	Bartlesville, Oklahoma

COMMITTEES, 1916-1917.

Advisory.

William Y. Cartwright, *Chairman*	Cincinnati, Ohio
Jesse C. McDowell	Pittsburgh, Pennsylvania
William H. McKenzie	Kansas City, Kansas
John M. Garard	Columbus, Ohio
Alexander B. Macbeth	Los Angeles, California
Martin B. Daly	Cleveland, Ohio
Ernest L. Brundrett	Kansas City, Missouri
James T. Lynn	Detroit, Michigan

Uniform Accounting.

H. C. Reeser, *Chairman*	Pittsburgh, Pennsylvania
V. A. Hays	Independence, Kansas
H. V. Shulters	Cleveland, Ohio
R. H. Bartlett	Pittsburgh, Pennsylvania
W. R. Hadley	Pittsburgh, Pennsylvania
C. W. Downing	Cleveland, Ohio
G. W. Ratcliffe	Pittsburgh, Pennsylvania
W. J. Judge	New York, New York
J. B. Tonkin	Pittsburgh, Pennsylvania
C. S. Mitchell	Pittsburgh, Pennsylvania
T. F. Wickham	Cincinnati, Ohio
G. C. Scott	Columbus, Ohio

Conservation.

Alfred J. Diescher, *Chairman*	Bartlesville, Oklahoma
Israel C. White	Morgantown, West Virginia
Ernest L. Brundrett	Kansas City, Missouri
William T. Griswold	Pittsburgh, Pennsylvania
Forrest M. Towl	New York, New York

New Members.

Henry S. Norris, *Chairman*	Buffalo, New York
George X. Wittmer	Pittsburgh, Pennsylvania
Raymond Cross	Oil City, Pennsylvania
H. A. Wallace	Charleston, West Virginia
H. C. Hoagland	Muskogee, Oklahoma

Committee on Rates.

S. M. Douglass, *Chairman*	Mansfield, Ohio
Alfred Hurlburt	Kansas City, Missouri
Donald McDonald	Louisville, Kentucky

Ways and Means Committee.

John M. Garard, *Chairman*	Columbus, Ohio
Martin B. Daly	Cleveland, Ohio
John E. Gill	Pittsburgh, Pennsylvania

Joint National Committee on Electrolysis.

Forrest M. Towl, *Chairman*	New York, New York
B. C. Oliphant	Buffalo, New York
S. S. Wyer	Columbus, Ohio

Committee of Awards for Wrinkle Department.

F. W. Stone, *Chairman*	Ashtabula, Ohio
A. P. Davis	Pittsburgh, Pennsylvania
W. J. Broder	Columbus, Ohio

United States Bureau of Standards, Gas Safety Code Conference.

Samuel S. Wyer, *Representative*	Columbus, Ohio

DIRECTORY OF MEMBERSHIP

(The date with each name is that of election to membership).

HONORARY MEMBERS.

Bailey, Edgar Henry Summerfield......................May 19, 1908
Professor of Chemistry, University of Kansas, 1101 Ohio Street, Lawrence, Kansas.

Bownocker, John Adams..............................May 18, 1909
State Geologist of Ohio, Ohio State University, 185 Fifteenth Avenue, Columbus, Ohio.

Gould, Charles Newton..............................May 17, 1910
Superintendent, Geological Department, Wichita Natural Gas Company, Bartlesville, Oklahoma.

Harmon, Judson.....................................May 18, 1909
Lawyer, Cincinnati, Ohio.

Haworth, Erasmus...................................May 21, 1907
Professor of Geology and Mining, University of Kansas, Lawrence, Kansas.

Sears, Clifton W..............................February 27, 1906
Medina Gas & Fuel Company, Mansfield, Ohio.

Sweetman, Michael M...........................February 27, 1906
Secretary, New York Oil and Gas Company, 316 American Bank Building, Kansas City, Missouri.

White, Israel C.....................................May 16, 1911
State Geologist of West Virginia, 141 Willey Street, Morgantown, West Virginia.

ACTIVE MEMBERS.

Abbe, Walter, Jr....................................May 16, 1916
Chief Engineer, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Abbott, C. G..May 16, 1916
Commercial Agent, The Springfield Gas Company, 221 West Fountain Avenue, Springfield, Ohio.

Abbott, D. E..May 18, 1915
Director, Huntington Development and Gas Company, 928 Third Avenue, Huntington, West Virginia.

Abbott, E. D..May 18, 1909
Superintendent, The Springfield Gas Company, 221 North Fountain Avenue, Springfield, Ohio.

Abell, H. C...May 21, 1912
Engineer, American Light and Traction Company, 120 Broadway, New York, New York.

Adams, J. A...May 16, 1916
Field Superintendent, American Natural Gas Company, R. F. D. No. 1, Cowansville, Pennsylvania.

Adams, Larmour .... May 21, 1912
Metric Metal Works, Tenth and Payne Avenue, Erie, Pennsylvania.

Adams, W. H .... May 16, 1916
Agent, Logan Natural Gas & Fuel Company, Ashland, Ohio.

Adams, William M .... May 16, 1916
Agent, Citizens Gas & Electric Company, Elyria, Ohio

Alden, John Douglas .... May 21, 1912
Assistant Superintendent, United Gas Improvement Company, 83 Center Street, Waterbury, Connecticut.

Allen, J. Foster .... May 18, 1909
Sinclair-Cudahy Pipe Line Company, P. O. Box 398, Drumright, Oklahoma.

Alexander, W. F .... May 18, 1915
Natural Gas Insurance, Clarksburg, West Virginia.

Allen, S. S., Jr .... May 21, 1907
Assistant Secretary, Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Altizer, R. G .... May 19, 1914
Counsel, United Fuel Gas Company, 1422 Kanawha Street, Charleston, West Virginia.

Amey, L. C .... May 19, 1914
Chief Engineer, Manufacturers Gas Company, Kane, Pennsylvania.

Anderson, Hugh .... May 16, 1916
Assistant Foreman, The Manufacturers Light & Heat Company, Reader, West Virginia.

Anderson, J. F .... May 16, 1916
Field Foreman, The Peoples Natural Gas Company, R. D. No. 1, Mayport, Pennsylvania.

Anderson, J. W .... May 18, 1915
Agent, United Fuel Gas Company, Ventura Hotel, Ashland, Kentucky.

Angle, J. E .... May 16, 1911
Superintendent, Fayette County Gas Company, 302 South Pittsburgh Street, Connellsville, Pennsylvania.

Ardis, J. B .... May 17, 1910
President, Louisiana Gas Company, Caddo and Commerce Streets, Shreveport, Louisiana.

Ardizzone, Joseph .... May 21, 1912
President, The Ardizzone Company, 507-508 Bliss Building, Tulsa, Oklahoma.

Armstead, Daniel M .... May 21, 1912
Engineer, Sales Department, Ingersoll-Rand Company, Farmers Bank Building, Pittsburgh, Pennsylvania

Armstrong, A. A .... May 18, 1909
Assistant General Manager, Union Natural Gas Corporation, 1615 Union Bank Building, Pittsburgh, Pennsylvania.

Arnold, W. H .... May 18, 1915
Representative, Pittsburgh, Valve, Foundry and Construction Company, 1817 Tonapah Avenue, Pittsburgh, Pennsylvania.

Arras, W. H .... May 16, 1916
Chief Clerk, Purchasing Department, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Ashley, Walter A .... May 16, 1916
Local Superintendent, Logan Natural Gas & Fuel Company, Chillicothe, Ohio.

Ashton, H. T..May 18, 1915
Assistant Engineer, The Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Atkins, I. H..May 16, 1916
District Manager, Union Gas & Electric Company, 4th and Plum Streets, Cincinnati, Ohio.

Ayer, J. W..May 19, 1914
Sales Manager, Reznor Mfg. Company, Reznor, Mercer, Pennsylvania.

Baehr, William Alfred..................................May 21, 1912
Consulting Engineer, 122 South Michigan Avenue, Chicago, Illinois.

Bagley, W. H..May 18, 1915
Agent, Osage & Oklahoma Company, Pioneer Building, Tulsa, Oklahoma.

Bair, Charles Edwin....................................May 16, 1911
Superintendent, Pine Bluff Natural Gas Company, 212 Barraque Street, Pine Bluff, Arkansas.

Baker, A. G..May 16, 1916
Superintendent, Tri County Natural Gas Company, Caledonia, New York.

Baker, Charles E......................................May 16, 1916
Field Foreman, The Manufacturers Light & Heat Company, R. F. D. No. 1, Wallace, West Virginia.

Baker, C. M..May 18, 1915
Chief Engineer, Petrolia Compressing Station, Lone Star Gas Company, Petrolia, Texas.

Baker, W. N..May 16, 1916
Foreman, Hope Natural Gas Company, R. F. D., Miletus, West Virginia.

Ballard, A. M..May 19, 1914
Construction Department, Ohio Fuel Supply Company, 101 North Front Street, Columbus, Ohio.

Ballard, Charles R......................................May 18, 1909
Manufacturer, Ballard Patent Suction and Discharge Valves, Midway, Pennsylvania.

Ballard, H. C..May 19, 1914
Superintendent of Lines, Wichita Pipe Line, 605 East Third Street, Bartlesville, Oklahoma.

Bane, K. H..May 18, 1915
Reserve Gas Company, Lock Box 123, Wilsonburg, West Virginia.

Barger, Louis F......................................May 20, 1913
General Superintendent, Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Barnes, Frank ....May 19, 1908
Secretary and Treasurer, Bristow Gas Company, Main Street, Bristow, Oklahoma.

Barnes, George W....................................June 12, 1906
Engineer, Pacific Pipe Line Company, 519 Title Insurance Building, Los Angeles, California.

Barnes, R. B..May 16, 1911
Dist. Superintendent, United Natural Gas Company, Mill Street, Brookville, Pennsylvania.

Barnsdall, Theodore N..................................May 18, 1909
President, Union Natural Gas Corporation, Farmers Bank Building, Pittsburgh, Pennsylvania.

Barnsdall, T. N., 2nd..................................May 19, 1914
Treasurer, The Highland Gas Company, 7 Chambers Street, Bradford, Pennsylvania.

Barr, James H..May 18, 1915
President, The National Supply Company, Pittsburgh, Pennsylvania, and Toledo, Ohio.

Barrett, M. F...May 19, 1914
President, The Cleveland Brass Mfg. Company, 4606-26 Hamilton Avenue, Cleveland, Ohio.

Barrett, William E....................................May 21, 1912
Gas Engineer, J. G. White & Company, Inc., 43-49 Exchange Place, New York, New York.

Barrows, George S....................................May 16, 1916
Manager Gas Heating Department, General Fire Extinguisher Company, 275 West Exchange Street, Providence, Rhode Island.

Barrows, L. E..May 18, 1915
Engineer, The Texas Company, Natural Gas Department, Ft. Worth, Texts.

Barry, James ....May 16, 1916
Foreman, Arkansas Natural Gas Company, Prescott, Arkansas.

Bartlett, E. O...May 16, 1911
Secretary-Treasurer, Moncton Tramways, Electricity & Gas Company, Ltd., 1013 Farmers Bank Building, Pittsburgh, Pennsylvania.

Bartlett, John C..May 16, 1916
Secretary and Treasurer, Oklahoma Natural Gas Company; Secretary and Treasurer, Caney River Gas Company; Secretary and Treasurer, Enid Natural Gas Company; Assistant Secretary and Assistant Treasurer, Osage & Oklahoma Company, 1402 Union Bank Building, Pittsburgh, Pennsylvania.

Bartlett, R. H...May 16, 1911
Assistant to the President, Oklahoma Natural Gas Company, 1402 Union Bank Building, Pittsburgh, Pennsylvania.

Bartley, E. L..May 18, 1909
General Superintendent, American Natural Gas Company, Park Building, Pittsburgh, Pennsylvania.

Bartley, H. J..May 16, 1916
Field Superintendent, American Natural Gas Company, Indiana, Pennsylvania.

Bartley, W. A...May 16, 1916
District Superintendent, American Natural Gas Company, Indiana, Pennsylvania.

Bartow, A. T..May 18, 1915
Distribution Engineer, Central Indiana Gas Company, Muncie, Indiana.

Batchelor, G. F...May 19, 1914
President, The Natural Gas Company of West Virginia, 323 Fourth Avenue, Pittsburgh, Pennsylvania.

Battin, Henry S..May 21, 1912
Assistant General Superintendent, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pa.

Baxter, John ....May 21, 1912
Superintendent, Tube Department, Republic Iron and Steel Company, 248 Fairgreen Avenue, Youngstown, Ohio.

Bauer, C. J........May 18, 1915
Purchasing Agent, Union Gas & Electric Company, 4th and Plum Streets, Cincinnati, Ohio.

Beach, Ralph A........May 16, 1916
Assistant to Superintendent, T. W. Phillips Gas & Oil Company, 120 East Cunningham Street, Butler, Pennsylvania.

Beans, H. P........May 16, 1916
District Superintendent, American Natural Gas Company, Indiana, Pennsylvania.

Beardsley, R. D........May 16, 1916
Assistant Treasurer, Hope Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Beaty, Elmer........May 16, 1916
Acting Superintendent, Manufacturers Gas Company, Bradford, Pennsylvania.

Beckett, D. J........May 16, 1916
Field Superintendent, American Natural Gas Company, R. F. D. No. 2, Cabot, Pennsylvania.

Bedford, A. C........May 16, 1916
President, The Peoples Natural Gas Company, 26 Broadway, New York, New York.

Bell, Charles D........May 21,1907
Superintendent, Kansas Natural Gas Company, 113 Miners Bank Building, Joplin, Missouri.

Benner, George K........May 16, 1916
President, Benner Drilling Tool Company, 6431-6433 Penn Avenue, East End, Pittsburgh, Pennsylvania.

Berwald, P. M........May 18, 1915
General Manager, The City of Bradford Gas & Power Corporation, Bradford, Pennsylvania.

Bevan, R. L........May 18, 1915
Second Assistant Treasurer, Calgary Gas Company, Limited, 215 Sixth Avenue, West, Calgary, Alberta, Canada.

Biddison, P. McDonald........May 21, 1907
Construction Engineer, Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Bigelow, Lucius Seymour........May 21, 1907
President, The Periodicals Publishing Company, 64 Pearl Street, Buffalo, New York.

Bigler, G. K........May 20, 1913
City Plant Foreman, United Natural Gas Company, Franklin, Pennsylvania.

Billingsley, J. E........May 16, 1916
Assistant Geologist, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Bishop, H. W. Jr........May 18, 1909
Representative, La Belle Iron Works, Steubenville, Ohio.

Black, James B........May 16, 1916
Agent, The Manufacturers Light & Heat Company, Cannonsburg, Pennsylvania.

Black, Tom M........May 16, 1916
Assistant Secretary, T. W. Phillips Gas and Oil Company, Butler, Pennsylvania.

Blair, J. C........May 18, 1915
President, Standard Fuel Company, Union Trust Building, Charleston, West Virginia.

Blinn, Arthur M .... May 20, 1913
Agent, Pennsylvania Gas Company, 1126-1128 Pearl Street, Erie, Pennsylvania.

Blum, William .... May 16, 1916
Superintendent, Sugar Grove Field, Logan Natural Gas & Fuel Company, Lancaster, Ohio.

Bodine, Samuel Taylor .... May 17, 1910
President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Boice, William .... May 16, 1916
Field Superintendent, American Natural Gas Company, R. F. D. No. 2, Sarver, Pennsylvania.

Boocks, C. W .... May 16, 1916
Foreman, Hope Natural Gas Company, Hastings, West Virginia.

Booth, Arthur .... May 17, 1910
Assistant General Purchasing Agent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Booth, George P .... May 19, 1908
General Superintendent, S. R. Dresser Mfg. Company, Bradford, Pennsylvania.

Boothe, R. E .... May 16, 1911
President, R. E. Boothe Cordage Company, 250 Granville Street, Newark, Ohio.

Booth, W. F .... May 20, 1913
Manager, Little Rock Gas & Fuel Company, 113 West Sixth Street, Little Rock, Arkansas.

Bormann, Clarence S .... May 16, 1916
Engineer, Carnegie Natural Gas Company, R. F. D. No. 4, Washington, Pennsylvania.

Bossert, J .... May 16, 1916
Field Superintendent, American Natural Gas Company, Allison Park, Pennsylvania.

Bothel, J. O .... May 16, 1916
District Superintendent, American Natural Gas Company, Leechburg, Pennsylvania.

Bowman, S. W .... May 18, 1915
Oil and Gas Producer, Clarksburg, West Virginia.

Boyd, A. E .... May 20, 1913
Superintendent, Ohio Fuel Supply Company, 141 East 4th Street, Ashland, Ohio.

Boyd, G. S .... May 18, 1915
Chief Engineer, Mooringsport Refining Company, Mooringsport, Louisiana.

Boyle, Patrick C .... May 20, 1913
President, The Derrick Publishing Company, 7 Centre Street, Oil City, Pennsylvania.

Braden, Eugene .... May 16, 1916
Contractor, Ardizzone Braden Company, 507 Bliss Building, Tulsa, Oklahoma.

Braden, Glenn T .... May 17, 1910
President, Oklahoma Natural Gas Company, 214 Pioneer Building, Tulsa, Oklahoma.

Braden, H. W .... May 18, 1915
Purchasing Agent, Dominion Natural Gas Company, 807 Bank of Hamilton, Ontario, Canada.

Bradford, Floyd J..May 19, 1914
Vice President, Parkersburg Rig and Reel Company, P. O. Box 974, Tulsa, Oklahoma.

Bradley, Harry ....May 20, 1913
President, Empire Gas & Fuel Company, Ltd., 78 North Main Street, Wellsville, New York.

Bradley, J. B..May 18, 1915
Secretary and Treasurer, Hornell Gas Light Company, 96 Main Street, Hornell, New York.

Braun, C. J., Jr..May 16, 1911
Treasurer, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Brawley, Hugh P..May 19, 1908
Claim Agent, 361 Walnut Street, Meadville, Pennsylvania.

Brazier, John B..May 18, 1915
Vice President and General Manager, Powhatan Brass & Iron Works, North Mildred Street and Belt Line Avenue, Ranson, Jefferson County, West Virginia.

Brendlinger, William B..May 17, 1910
Pittsburgh Manager, Ingersoll-Rand Company, 2020 Farmers Bank Building, Pittsburgh, Pennsylvania.

Brenner, H. H..May 21, 1912
President, Pawhuska Oil and Gas Company, Pawhuska, Oklahoma.

Brewster, Henry ....May 16, 1916
Foreman, Hope Natural Gas Company, Weston, West Virginia.

Bridges, J. M..May 20, 1913
Agent, United Natural Gas Company, Liberty Street, Franklin, Pennsylvania.

Brink, George R..May 18, 1909
Assistant Secretary-Treasurer, Union Natural Gas Corporation, Union Bank Building, Pittsburgh, Pennsylvania.

Brink, R. W..May 16, 1916
General Auditor, Hope Natural Gas Company, 26 Broadway, New York, New York.

Broder, William J..May 18, 1909
Assistant General Manager, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Brown, Cameron..May 16, 1916
Campaign Manager, General Gas Light Company, 44 West Broadway, New York, New York.

Brown, D. J..May 18, 1909
Treasurer, Oil Well Supply Company, 213 Water Street, Pittsburgh, Pennsylvania.

Brown, E. R..May 16, 1911
General Manager, Lone Star Gas Company, Corsicana, Texas.

Brown, Louis ....May 19, 1914
President, Oil Well Supply Company, 215 Water Street, Pittsburgh, Pennsylvania.

Brown, William Laird..May 16, 1916
Representative, Helm & McIlhenny, 1339 Cherry Street, Philadelphia, Pennsylvania.

Brown, W. Re..May 18, 1915
New Business Manager, The Ohio Fuel Supply Company, 97 North Front Street, Columbus, Ohio.

Bruce, W. W .... May 21, 1912
Superintendent, Oklahoma Fuel Supply Company, P. O. Box "L," Chandler, Oklahoma.

Brundrett, Ernest L .... May 21, 1907
President, Kansas City Gas Company, 910 Grand Avenue Kansas City, Missouri.

Bryant, C. L .... May 18, 1915
President, The Bryant Heater & Manufacturing Company, 978 East Sixty-fourth Street, Cleveland, Ohio.

Buchanan, James I .... May 16, 1916
President, Taylorstown Natural Gas Company, Terminal Office Building, Pittsburgh, Pennsylvania.

Buckley, W. H .... May 18, 1915
First Engineer, Rogers Compressing Station, Arkansas Natural Gas Company, Lewis, Louisiana.

Bulger, J. F .... May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Turtle Creek, Pennsylvania.

Bullock, C. L .... February 27, 1906
Superintendent Distribution, Wichita Gas Company, 401 Beacon Building, Wichita, Kansas.

Burford, Ira S .... May 16, 1916
Agent, United Fuel Gas Company, Inc., 114 North Third Street, Ironton, Ohio.

Burkhalter, R. J .... May 20, 1913
Assistant Secretary and Treasurer, The Northwestern Ohio Natural Gas Company, 210-213 Huron Street, Toledo, Ohio.

Burnett, A. B .... May 16, 1916
District Superintendent, American Natural Gas Company, Zelienople, Pennsylvania.

Burns, E. G .... May 18, 1915
Land Agent, Columbia Gas & Electric Company, 1668 Sixth Avenue, Huntington, West Virginia.

Burns, T. P .... May 16, 1916
Shop Foreman, Hope Natural Gas Company, 1212 Juliana Street, Parkersburg, West Virginia.

Burnside, S. E. W .... May 16, 1916
Attorney, Hope Natural Gas Company, 319 Barnes Street, Wilkinsburg, Pennsylvania.

Burr, R. B .... May 20, 1913
Industrial Engineer, The Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Burrell, George A .... May 20, 1913
Chief Gas Chemist, United States Bureau of Mines, 6706 Penn Avenue, Pittsburgh, Pennsylvania.

Burritt, D. F .... May 18, 1915
General Superintendent, National Gas, Electric Light and Power Company, 1714 Ford Building, Detroit, Michigan.

Burson, F. G .... May 16, 1916
Field Foreman, The Manufacturers' Light & Heat Company, Proctor, West Virginia.

Burson, H. W .... May 16, 1916
President, Colonial Supply Company, 414 First Avenue, Pittsburgh, Pennsylvania.

Burtner, James C .... May 16, 1916
Gas Well Contractor, Burtner & Morgan, East Liberty Street, Wooster, Wayne County, Ohio.

Cabot, Godfrey L........May 19, 1914
Proprietor, Plant at Cabot, Pennsylvania, 940 Old South Building, Boston, Massachusetts.

Callanan, J. T........May 18, 1915
President and Treasurer, Parkersburg Machine Company, 505 Juliana Street, Parkersburg, West Virginia.

Caffrey, George H........May 19, 1914
Manager, Abilene Gas and Electric Company, 126 Cypress Street, Abilene, Texas.

Campbell, J. P........May 16, 1916
Foreman, Hope Natural Gas Company, Littleton, West Virginia.

Campbell, J. T........May 16, 1916
Agent, The Manufacturers' Light & Heat Company, Newcastle, Pennsylvania.

Campbell, M. L........May 16, 1916
Pittsburgh and West Virginia Company, Salem, West Virginia.

Cantrell, C. C........May 17, 1910
Vice President and Manager, Central Light & Fuel Company, 21 East Hobson Avenue, Sapulpa, Oklahoma.

Cappeau, J. P., Jr........May 16, 1911
Secretary and Treasurer, The Natural Gas Engineering Company, 801 Machesney Building, 223 Fourth Avenue, Pittsburgh, Pennsylvania.

Carey, Gail........May 21, 1912
Secretary, The Garnett Light & Fuel Company, Garnett, Kansas.

Carmody, M. B........May 18, 1909
Field Manager, South Western Gas & Electric Company, 1754 Irving Place, Shreveport, Louisiana.

Carpenter, Everett........May 19, 1914
Chief Geologist, Continental Oil & Gas Company, Bartlesville, Oklahoma.

Carpenter, George K........May 16, 1916
Superintendent, United Fuel Gas Company, 1207 Elmwood Avenue, Charleston, West Virginia.

Carson, W. B........May 16, 1911
Secretary, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Carter, C. E........May 18, 1915
President, Mansfield Gas Light Company, 8 South Park Street, Mansfield, Ohio.

Carter, Clarence E........May 18, 1915
Salesman, The Ohio Fuel Company, 97 North Front Street, Columbus, Ohio.

Carter, David J........May 16, 1916
Attorney-at-Law, Carter and Sheets, 419-421 Goff Building, Clarksburg, West Virginia.

Carter, J. H........May 19, 1907
Superintendent, Gas Department, Home Light, Heat & Power Company, 512 North Broadway, Pittsburgh, Kansas.

Carter, O. M........May 16, 1916
President, United Gas Iron Company, Peoples Gas Building, Chicago, Illinois.

Cartwright, T. R........May 16, 1916
Superintendent, United Fuel Gas Company, Clendenin, West Virginia.

Cartwright, William Y....................May 21, 1912
Vice President, Union Gas and Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Cashdollar, O. W....................May 16, 1916
Claim Agent, American Natural Gas Company, 1511 Park Building, Pittsburgh, Pennsylvania.

Cassel, Howard N....................May 20, 1913
Secretary-Treasurer and General Manager, Leflore County Gas & Electric Company, Poteau, Oklahoma.

Casto, A. T....................May 16, 1916
Superintendent, Randall Gas Company, 190 Chancery Row, Morgantown, West Virginia.

Cavenau, Charles ....May 16, 1916
Foreman Reserve Gas Company, Reserve Gas Company, Wilsonburg, West Virginia.

Cavenagh, Frank ....May 17, 1910
Pacific Coast Representative, Metric Metal Works, 616 Title Insurance Building, Los Angeles, California.

Chandler, L. F....................May 18, 1915
Superintendent, Santa Maria Gas & Power Company, 203 West Main Street, Santa Maria, California.

Chaplin, William C....................May 17, 1910
Treasurer, The Chaplin-Fulton Manufacturing Company, 34 Penn Avenue, Pittsburgh, Pennsylvania.

Chapman, W. B....................May 16, 1916
Oil Producer, 74 Vandergrift Building, Pittsburgh, Pennsylvania.

Church, H. H....................May 16, 1914
President and General Manager, The Killbuck & Millersburg Oil & Gas Company, Millersburg, Ohio.

Clagett, E. F....................May 18, 1915
Engineer, The Columbus Gas and Fuel Company, 135 North Front Street, Columbus, Ohio.

Clapp, G. N....................May 18, 1909
Secretary-Treasurer and General Manager, Washington Gas & Electric Company, Washington C. H., Ohio.

Clark, Earl A....................May 16, 1911
Proportional and Domestic Service, Meter Testing, 217 A. W. 5th, Tulsa, Oklahoma.

Clark, James ....May 19, 1914
Division Superintendent, Philadelphia Company, 17th and Wharton Streets, Pittsburgh, Pennsylvania.

Clark, J. S....................May 19, 1914
Manager, Okmulgee Gas Company, 319 West Sixth Street, Okmulgee, Oklahoma.

Clark, Raleigh....................May 21, 1912
President and Manager, Olney Gas Company, 318 South Whittle Avenue, Olney, Illinois.

Clark, Robert E....................May 16, 1916
Chief Field Agent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Clark Walton....................May 21, 1907
Second Vice President, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Clarkson, R. J....................May 19, 1914
Division Superintendent, Philadelphia Company of West Virginia, Littleton, West Virginia.

Clifford, Thomas C....................................May 19, 1911
Sales Manager, Pittsburgh Meter Company, East Pittsburgh, Pennsylvania.

Cline, Walter B....................................May 21, 1912
President, Los Angeles Gas and Electric Corporation, 645 South Hill Street, Los Angeles, California.

Clover, M. K....................................May 18, 1915
Manager, Berea Pipe Line Company, 9 Front Street, Berea, Ohio.

Cluley, C. F....................................May 20, 1913
Agent, The East Ohio Gas Company, Millersburg, Ohio.

Cochran, Horace J....................................May 18, 1915
President and Manager, Maysville Gas Company, Maysville, Kentucky.

Cohn, Charles M....................................May 21, 1912
Vice President, Cons. Gas, Electric Light & Power Company of Baltimore, 100 West Lexington Street, Baltimore, Maryland.

Cole, E. J....................................May 16, 1911
Purchasing Agent and Auditor, Arkansas Natural Gas Company, State Bank Building, Little Rock, Arkansas.

Cole, W. E....................................May 16, 1911
Division Superintendent, Philadelphia Company, Main Street, Sharpsburgh, Pennsylvania.

Coleman, L. G....................................May 19, 1914
Engineer, Henry L. Doherty & Company, 60 Wall Street, New York, New York.

Collins, Frank ....May 18, 1915
Vice President, National Supply Company, President, Toledo Pipe Threading Machine Company, Toledo, Ohio.

Conley, J. E....................................May 16, 1916
Field Superintendent, American Natural Gas Company, Glenshaw, Pennsylvania.

Connelly, J. S....................................June 12, 1906
President, Port Arthur Gas Company, Port Arthur, Texas.

Cooper, H. C....................................May 20, 1913
General Superintendent, Hope Natural Gas Company, Clarksburg, West Virginia.

Corbett, M. A....................................May 17, 1910
Secretary, Corbett-Stevens Company, Huntington Bank Building, Columbus, Ohio.

Corbus, C. D....................................May 20, 1913
Manager, Welsbach Company, 429 Main Street, Cincinnati, Ohio.

Corcoran, W. F....................................May 21, 1907
Contractor, James G. Corcoran Company, 415 House Building, Pittsburgh, Pennsylvania.

Cork, D. W....................................May 18, 1915
Oil and Gas Producer, Clarksburg, West Virginia,

Corrin, John B....................................May 20, 1913
Assistant General Manager, Hope Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Coste, Dillon ....May 20, 1913
Secretary, The Canadian Western Natural Gas, Light, Heat & Power Company, Limited, 128 Seventh Avenue, East Calgary, Alberta, Canada.

Coste, Eugene .... May 20, 1913
President, The Canadian Western Natural Gas, Light, Heat & Power Company, Limited, 128 Seventh Avenue, East Calgary, Alberta, Canada.

Coulter, A. F .... May 16, 1916
Field Superintendent, American Natural Gas Company, Apollo, Pennsylvania.

Covey, A. F .... May 18, 1915
Superintendent, Dominion Natural Gas Company, 807 Bank of Hamilton Building, Hamilton, Ontario, Canada.

Covey, C. F .... May 16, 1916
Treasurer, McAuley Automatic Trap Company, Imperial Power Building, Pittsburgh, Pennsylvania.

Courtney, D. H .... May 18, 1915
President, Randall Gas Company, 179 High, Morgantown, West Virginia.

Cowham, H. I .... May 21, 1912
Manager Land Department, Kasigan Oil, Gas & Power Company, 115½ East Main Street, Independence, Kansas.

Cox, Frank .... May 18, 1915
Secretary, Navajo Gas Company, Charleston, West Virginia.

Coyle, Henry .... May 18, 1909
Superintendent, Mains and Field, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Craft, Charles .... May 15, 1911
Chief Engineer, East Ohio Gas Company, West Park, Ohio.

Crahan, B. J .... May 17, 1910
Superintendent, Joplin Gas Company, 318 Joplin Street, Joplin, Missouri.

Craig, Albert B .... May 16, 1916
Geologist, Greensboro Gas Company, 248 Fourth Avenue, Pittsburgh, Pennsylvania.

Craig, W. P .... May 20, 1913
General Superintendent, United Natural Gas Company, 308 Seneca Street, Oil City, Pennsylvania.

Crawford, A. A .... May 16, 1916
Superintendent, Manufacturers Gas Company, Bradford, Pennsylvania.

Crawford, C. E .... May 16, 1911
Director, Ohio Fuel Supply Company, 2017 Farmers Bank Building, Pittsburgh, Pennsylvania.

Crawford, C. J .... May 16, 1916
1028 Liberty Street, Franklin, Pennsylvania.

Crawford, David B .... May 16, 1911
General Manager, Parkersburg Rig and Reel Company, 450 Second Street, Parkersburg, West Virginia.

Crawford, F. H .... May 16, 1911
Chief Engineer, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Crawford, Frederick W .... May 18, 1909
President, United Fuel Gas Company, 52 West Gay Street, Columbus, Ohio.

Crawford, George W .... May 17, 1910
President, Ohio Fuel Supply Company, 2017 Farmers Bank Building, Pittsburgh, Pennsylvania.

Crawford, James B..May 16, 1911
President, United Natural Gas Company, 308 Seneca Street, Oil City, Pennsylvania.

Crawford, John M..May 16, 1911
President, Parkersburg Rig and Reel Company, Box 624 Parkersburg, West Virginia.

Crawford, J. W. R..May 16, 1911
Vice President, Hope Natural Gas Company, Room 502, 26 Broadway, New York. New York.

Crawford, R. A..May 20, 1913
Vice President and Manager, Oblong Gas Company, West Main Street, Palestine, Illinois.

Crawford, Ronald B..May 20, 1913
Superintendent, United Natural Gas Company, 116 Bissell Avenue, Oil City, Pennsylvania.

Critchfield, C. F..May 16, 1916
Special Inspector, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Cronin, John M..May 18, 1915
Clerk, Columbia Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Crosby, G. A..May 16, 1916
Superintendent, Land Department, Porter Gas Company, Farmers Bank Building, Pittsburgh, Pennsylvania.

Cross, F. A..May 20, 1913
Chief Station Engineer, United Natural Gas Company, Ten Mile Bottom, Pennsylvania.

Cross, Raymond..May 16, 1911
Vice President and General Manager, United Natural Gas Company, 308 Seneca Street, Oil City, Pennsylvania.

Crossett, John..May 16, 1911
Division Superintendent, Philadelphia Company, Arch Street, Kittanning, Pennsylvania.

Crowe, R. R..May 19, 1914
Agent, United Natural Gas Company, 75 Main Street, Bradford, Pennsylvania.

Crum, M. C..May 16, 1916
Agent, The Peoples Natural Gas Company, Monessen, Pennsylvania.

Cullinan, M. P..May 20, 1913
President, Border Gas Company, 1418 Chihuahua Street, Laredo, Texas.

Cumings, C. E..May 19, 1914
President and General Manager, East Brady Gas Fuel Company, East Brady, Pennsylvania.

Cummings, Con..May 21, 1912
Superintendent, Portland Gas and Pipe Line Company, 115 North Fourth Street, Independence, Kansas.

Cummings, Henry..May 16, 1916
Field Foreman, The Manufacturers Light & Heat Company, McDonald, Pennsylvania.

Cummings, M. J..May 16, 1916
Field Foreman, The Manufacturers Light and Heat Company, Cameron, West Virginia.

Cunningham, J. C..May 18, 1909
General Superintendent, West Virginia and Maryland Gas Company, 9½ South Centre Street, Cumberland, Maryland.

Curry, J. F..........May 16, 1911
Superintendent, Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Cunningham, R. H..........May 16, 1916
Sales Engineer, Ingersoll-Rand Company, 1226 Farmers Bank Building, Pittsburgh, Pennsylvania.

Curry, J. P..........May 20, 1913
Agent, United Natural Gas Company, 15 Vine Street, Sharon, Pennsylvania.

Curtis, Austin G..........May 19, 1908
General Manager, Southwestern Gas & Electric Company, 116 Texas Street, Shreveport, Louisiana.

Cusack, W. M..........May 20, 1913
Treasurer, Iroquois Natural Gas Company, 45 Church Street, Buffalo, New York.

Cushing, Robort W..........May 19, 1914
Field Superintendent, Natural Gas Company of West Virginia, Leetonia, Columbiana County, Ohio.

Custer, Z. B..........May 19, 1908
Vice President, Custer Coupling Company, 39 Foreman Street, Bradford, Pennsylvania.

Cypher, M. B..........May 16, 1916
Contractor and Producer, Marwood, Pennsylvania.

Dallow, J. C..........May 18, 1909
Representative, The National Supply Company, Lancaster, Ohio.

Dally, A. B., Jr..........May 18, 1909
President and Manager, South Hills Oil and Gas Company, Benedum-Trees Building, Pittsburgh, Pennsylvania.

Dally, C. A., Jr..........May 20, 1913
Manager, Reserve Natural Gas Company of Louisiana, P. O. Box 191, Shreveport, Louisiana.

Daly, Martin B..........May 18, 1909
President and General Manager, The East Ohio Gas Company, East Ohio Gas Building, Cleveland, Ohio.

Dana, J. W..........May 17, 1910
Lawyer, The Wyandotte County Gas Company, 401-2-3 Husted Building, Kansas City, Kansas.

Daugherty, O. J..........May 18, 1915
Superintendent, La Belle Gas & Oil Company, 220 West Street, Steubenville, Ohio.

Davies, O. L..........May 18, 1915
Agent, United Fuel Gas Company, 814 Fourth Avenue, Huntington, West Virginia.

Davies, Stuart W..........May 16, 1916
Information Department, Calgary Gas Company, Limited, 215 Sixth Avenue, West, Calgary, Alberta, Canada.

Davies, William B May 16, 1916
Assistant Superintendent, Alden Batavia Gas Company, 308 Washington Avenue, Batavia, New York.

Davis, A. P..........May 20, 1913
Commercial Manager, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Davis, Herbert R..........May 21, 1907
Dominion Gas Company, Marine National Bank Building, Buffalo, New York.

Davis, Merrill N..........May 16, 1916
Salesman, The B. F. Goodrich Company, Akron, Ohio.

Davis, Silas...May 16, 1916
Engineer, The Manufacturers Light & Heat Company, R. F. D. No. 1, Wallace, West Virginia.

Davis, W. M...May 16, 1911
Secretary and Assistant Treasurer, Wichita Natural Gas Company, Suite 727 Beacon Building, Wichita, Kansas.

Dawes, Beman G...May 17, 1910
President, Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Dawes, Henry M...May 17, 1910
President, Pulaski Gas Light Company, (Little Rock, Arkansas), 1615 Harris Trust Building, Chicago, Illinois.

Day, R. D...May 16, 1911
Mechanical Engineer, Mesta Machine Company, 5906 Howe Street Pittsburgh, Pennsylvania.

Dean, H. Alexander..May 16, 1916
President, Elk Natural Gas Company, 223 Fourth Avenue, Pittsburgh, Pennsylvania.

Deemer, F. C..May 18, 1909
Gas and Oil Operator, 200 Jefferson Street, Brookville, Pennsylvania.

Delaney, Joseph P...May 20, 1913
City Superintendent, The Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Denning, Leslie B...May 20, 1911
General Counsel, Ohio Fuel Supply Company, 50 East Broad Street, Columbus, Ohio.

Devericks, Filmore C..May 16, 1916
Independent Producer, 251 Buena Vista Avenue, Clarksburg, West Virginia.

Dibbens, W. J...May 19, 1908
Vice President and General Manager, Guthrie Gas Light, Fuel & Improvement Company, 213 East Oklahoma Avenue, Guthrie, Oklahoma.

Diescher, Alfred J..May 18, 1909
Vice President and General Manager, Wichita Natural Gas Company, Pioneer Telephone Building, Bartlesville, Oklahoma.

Dietrich, C. R..May 16, 1916
Agent, The Peoples Natural Gas Company, Turtle Creek, Pennsylvania.

Dill, S. J..May 21, 1912
President, Leavenworth, Kansas Light, Heat & Power Company, 40 Wall Street, New York, New York.

Dimick, W. H..May 20, 1913
Agent, The East Ohio Gas Company, 202 West High Street, New Philadelphia, Ohio.

Dingman, L. R...May 16, 1916
District Foreman, Equitable Gas Company, Second Street, Braddock, Pennsylvania.

Dittman, C. E...May 17, 1910
Manager, Waynesburg Home Gas Company, Waynesburg, Pennsylvania.

Ditto, William A..May 16, 1916
Superintendent, Bradford Gas Company, Roulette, Pennsylvania.

Dixon Philip ....May 18, 1916
Superintendent, St. Marys Gas Company, St. Marys, Pennsylvania.

Dixon, P. E..May 16, 1916
District Superintendent, American Natural Gas Company, Ford City, Pennsylvania.

Doane, J. R..May 19, 1914
Oklahoma Salesman, Fairbanks, Morse & Company, 4624 West Broadway, Muskogee, Oklahoma.

Dodds, Caryl ....June 12, 1906
General Manager, Citizens Light, Heat & Power Company, 5 East Henry Street, Lawrence, Kansas.

Doherty, Henry L....................................February 27, 1906
President, Cities Service Company, 60 Wall Street, New York, New York.

Doherty, James A....................................May 20, 1913
Manager, Woodstock Gas Light Company, Woodstock, Ontario, Canada.

Dolen, R. F..May 16, 1916
Foreman, Pittsburgh and West Virginia Gas Company, 965 West Street, Clarksburg, West Virginia.

Donaldson, F. N....................................May 16, 1911
Owner, Donaldson Gas Company, Jewett, Ohio.

Donnelly, William E..................................May 16, 1916
General Superintendent, Northeastern Oil & Gas Company, Geneva, Ohio.

Donovan, B. H......................................May 20, 1913
Foreman, Pennsylvania Gas Company, 1021 French Street, Erie, Pennsylvania.

Dougherty, F. D....................................May 16, 1916
Superintendent Gas Wells, William Harris Company, Wooster, Wayne County, Ohio.

Douglass, Silas M..................................May 18, 1909
General Counsel, Logan Natural Gas & Fuel Company, 22½ South Park Street, Mansfield, Ohio.

Douthirt, W. F....................................May 21, 1907
Fourth Vice-President, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Downing, C. W......................................May 20, 1913
Assistant Secretary and Treasurer, East Ohio Gas Company, East Sixth Street, Cleveland, Ohio.

Doyle, Frederick ....May 19, 1914
Assistant Superintendent Compressor Stations, Kansas Natural Gas Company, Independence, Kansas.

Dreibelbis, H. H....................................May 21, 1912
Division Superintendent, The Ohio Fuel Supply Company, 59 North Fourth Street, Zanesville, Ohio.

Droppleman, W. J..................................May 16, 1916
Foreman, Hope Natural Gas Company, McWhorter, West Virginia.

Duffield, C. S......................................May 16, 1916
Purchasing Agent, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Duffield, James C..................................May 20, 1913
Managing Director, London City Gas Company, London, Ontario, Canada.

Duncan, John ....May 16, 1911
General Manager Sales, Wheeling Steel & Iron Company, Wheeling, West Virginia.

Dunham, Carl Cyrus........May 16, 1916
Meter Department, Pittsburgh & West Virginia Gas Company, 3 Center Avenue, Weston, West Virginia.

Dusenberry, D. F........May 16, 1916
Gas Engineer, West Virginia Traction & Electric and City and Suburban Gas Company, Morgantown, West Virginia.

Eagleson, James P........May 16, 1916
Director, Manufacturers Light & Heat Company, 6 South Main Street, Washington, Pennsylvania.

Eastland, S. H........May 16, 1916
District Foreman, Philadelphia Company, 23rd and Main Streets, Sharpsburg, Pennsylvania.

Edwards, William C........May 16, 1916
Vice President, Parker and Edwards Oil Company, Union Bank Building, Pittsburgh, Pennsylvania.

Egan, E. J........May 16, 1916
Agent, The Manufacturers Light & Heat Company, Millbridge and Manton Streets, Pittsburgh, Pennsylvania.

Egbert, H. T........May 20, 1913
Agent, United Natural Gas Company, 206 Seneca Street, Oil City, Pennsylvania.

Elbert, Vincent L........May 19, 1914
General Manager, St. Joseph Gas Company, Eighth and Francis Street, St. Joseph, Missouri.

Emmerling, Karl........May 18, 1915
Chemist, The East Ohio Gas Company, 3105 Walton Avenue, Cleveland, Ohio.

Engle, T. W........May 19, 1914
Division Superintendent, Pittsburgh & West Virginia Gas Company, Grafton, West Virginia.

Enslow, F. B........May 18, 1909
Vice President and General Counsel, Columbia Gas & Electric Company, Third Avenue and Tenth Street, Huntington, West Virginia.

Ernst, H. M........May 18, 1915
President, Dempseytown Gas Company, Treet Company Building, Oil City, Pennsylvania.

Espach, Frank........May 18, 1915
Chief Inspector, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Evans, C. D........May 16, 1911
Division Superintendent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Evans, J. J........May 18, 1915
Division Superintendent, Hope Natural Gas Company, Clarksburg, West Virginia.

Ewing, J. J........May 16, 1916
House Piper, Own business, 952 Fifth Avenue, Coraopolis, Pennsylvania.

Fair, F........May 18, 1915
Superintendent, Brantford Gas Company, 15 Colforne Street, Brantford, Ontario, Canada.

Falk, F. I........May 18, 1915
Assistant Treasurer, The Ohio Fuel Supply Company, 2017 Farmers Bank Building, Pittsburgh, Pennsylvania.

Farner, J. W..May 16, 1916
Superintendent, Potter Gas Company, Port Allegheny, Pennsylvania.

Felix, Otto F..May 21, 1912
Secretary and Treasurer, Equitable Meter Company, 422 First Avenue, Pittsburgh, Pennsylvania.

Fields, R. A..May 18, 1915
New Business Manager, National Gas, Electric Light & Power Company, 1714 Ford Building, Detroit, Michigan.

Filler, W. H..May 20, 1913
Secretary and Treasurer, Pennsylvania Gas Company, 213 Second Avenue, Warren, Pennsylvania.

Finley, H. F..May 16, 1916
Agent, Logan Natural Gas & Fuel Company, Tiffin, Ohio.

Finney, Frank F..May 17, 1910
Superintendent of Gas Lines, Indian Territory Illuminating Oil Company, Bartlesville, Oklahoma.

Fischer, George J..May 21, 1907
Secretary and Manager, Modern Iron Works, Quincy, Illinois.

Fish, Harry P..May 20, 1913
General Foreman, The East Ohio Gas Company, 163 Tod Lane, Youngstown, Ohio.

Fisher, Francis P..May 21, 1907
Assistant General Manager, Wichita Natural Gas Company, Pioneer Telephone Building, Bartlesville, Oklahoma.

Fleming, Arthur C..May 18, 1915
Superintendent, Pennsylvania Fuel Supply Company, Broad Street, New Bethlehem, Pennsylvania.

Fleming, Claude M..May 16, 1916
Foreman, Hope Natural Gas Company, 202 Locust Street, Mannington, West Virginia.

Fleming, Curtis B..May 16, 1916
Producer Oil and Gas, P. O. Box 193, Fairmont, West Virginia.

Fletcher, John A..May 16, 1916
Agent, The Manufacturers Light & Heat Company, Bellaire, Ohio.

Flinn, T. W. H..May 16, 1916
Appliances, Flinn Appliance House, 607 West Main Street, Denison, Texas.

Flocken, Alfred F..May 16, 1916
Bookkeeper, Union Gas & Electric Company, 2241 Loth Street, Cincinnati, Ohio.

Foley, John..May 18, 1915
General Field Superintendent, The Manufacturers Light & Heat Company, Cannonsburg, Pennsylvania.

Foley, T. B..May 16, 1916
Contractor, T. B. Foley, 410 Diamond Bank Building, Pittsburgh, Pennsylvania.

Foley, T. H..May 16, 1916
Superintendent, T. B. Foley, Contractor, 410 Diamond Bank Building, Pittsburgh, Pennsylvania.

Fonner, George..May 16, 1916
Field Superintendent, American Natural Gas Company, R. F. D., Gibsonia, Pennsylvania.

Fonner, J. H..May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Midland, Pennsylvania.

Ford, C. L..May 19, 1914
Superintendent Land & Leaseholders, Wichita Natural Gas Company, 507 Johnstone Avenue, Bartlesville, Oklahoma.

Ford, John C..May 18, 1915
District Superintendent, South Penn Oil Company, Union Trust Building, Charleston, West Virginia.

Forman, H. A..May 16, 1911
Vice President, Eastern Oil Company, 312 Fidelity Building, Buffalo, New York.

Forstall, Alfred E..May 21, 1912
Consulting Engineer, Forstall and Robison, 84 William Street, New York, New York.

Foster, H. V..May 21, 1912
President, Indian Territory Illuminating Oil and Gas Company, 111 East Eighth Street, Bartlesville, Oklahoma.

Foster, J. E..May 20, 1913
Agent, The East Ohio Gas Company, 107 North Erie Street, Massillon, Ohio.

Foster, D. H..May 18, 1915
Secretary, Ohio Oil Association, 808 Harrison Building, Columbus, Ohio.

Fox, E. C..May 18, 1915
Manager, The Gas Appliance Company, 713 Frankfort Avenue, Cleveland, Ohio.

Frainer, J. E..May 18, 1915
Sun Gas Company, Salem, West Virginia.

Frantz, I. D..May 16, 1916
Foreman, Hope Natural Gas Company, Smithville, West Virginia.

Franz, W. E..May 18, 1915
Street Foreman, Natural Gas Department, The Dayton Gas Company, 218 South Jefferson Street, Dayton, Ohio.

Frazier, J. E..May 18, 1915
Superintendent, Charleston-Dunbar Natural Gas Company, 404 Ruffner Avenue, Charleston, West Virginia.

Freeland, Claude L..May 19, 1914
President, Bristow Gas Company, Bristow, Oklahoma.

Freeman, W. H..May 18, 1915
President, Union Gas & Electric Company, 4th and Plum Streets, Cincinnati, Ohio.

Frees, W. H..May 16, 1916
Rig Builder, 136 East Bowman, Wooster, Ohio.

Freudenberger, William ....May 18, 1915
President, Freudenberger Oil Company, 504 Charleston, National Bank Building, Charleston, West Virginia.

Friedenberg, D..May 18, 1909
Auditor, Union Natural Gas Corporation, 34 Ruggery Building, Columbus, Ohio.

Frohrieb, L. C..May 16, 1911
Secretary, Federal Engineering Company, 1116 House Building, Pittsburgh, Pennsylvania.

Fulton, Louis B..May 17, 1910
President, The Chaplin-Fulton Manufacturing Company, 34 Penn Avenue, Pittsburgh, Pennsylvania.

Funk, F. O..May 19, 1914
Oil and Gas Operators, Cochran & Funk, Eighth Street, Moundsville, West Virginia.

Funk, W. T .... May 18, 1915
Auditor, Oil and Gas Companies, Titusville, Pennsylvania.

Fye, J. L .... May 16, 1911
Division Superintendent, Philadelphia Company, 261 High Street, Waynesburg, Pennsylvania.

Gage, W. P .... May 17, 1910
Vice President and General Superintendent, Lone Star Gas Company, 807-8-9-10 First National Bank Building, Fort Worth, Texas.

Gager, H. A .... May 18, 1915
The Natural Gas Company of West Virginia, 156 East Fifth Street, Salem, Ohio.

Gallagher, C. E .... May 20, 1913
Agent, The East Ohio Gas Company, Youngstown, Ohio.

Gallagher, R. W .... May 21, 1912
Assistant General Manager, The East Ohio Gas Company, East Ohio Gas Building, Cleveland, Ohio.

Galvin, T. L .... May 19, 1914
Inspector, National Tube Company, 509 Pitt Street, Wilkinsburg, Pennsylvania.

Garard, Charles H .... May 19, 1914
Superintendent, Southern Ohio Division, The Ohio Fuel Supply Company, 124 North Pennsylvania Avenue, Wellston, Ohio.

Garard, F. L .... May 16, 1916
Assistant Superintendent and Agent, Fayette County Gas Company, 403 First National Bank Building, Uniontown, Pennsylvania.

Garard, John Mesmore .... May 18, 1909
Second Vice President and General Manager, Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Gardner, C. W .... May 16, 1916
The East Ohio Gas Company, East Ohio Gas Building, Cleveland, Ohio.

Garner, J. B .... May 16, 1916
Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pennsylvania.

Garrity, M. J .... May 16, 1916
District Foreman, Equitable Gas Company, 9th Street, McKeesport, Pennsylvania.

Gassdorf, G. I .... May 16, 1916
Superintendent of Construction, The Huntington Development & Gas Company, 928 Third Avenue, Huntington, West Virginia.

Gassett, A. L .... May 19, 1908
Representative, Trenkamp Stove & Manufacturing Company, 9806 Quincy Avenue, Cleveland, Ohio.

Gates, C. B .... May 20, 1913
Chief Clerk, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Gates, John, Jr .... May 16, 1911
Attorney, Land Department, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Geary, D. J .... May 16, 1911
Sales Manager, Republic Iron & Steel Company, Republic Building, Youngstown, Ohio.

Geist, J. F....................May 16, 1916
Field Superintendent, United Fuel Gas Company, Ravenswood Pike, Spencer, West Virginia.

Germer, E. G....................May 20, 1913
President, Germer Stove Company, 16th and Parade Streets, Erie, Pennsylvania.

Gibson, C. A....................May 19, 1908
Kansas Natural Gas Company, Independence, Kansas.

Gibson, W. C....................May 17, 1910
Manager, Wichita Falls Gas Company, Kemp and Kell Building, Wichita, Kansas.

Giegel, F. G....................May 20, 1913
General Foreman, The Northwestern Natural Gas Company, 210-212 Huron Street, Toledo, Ohio.

Gifford, B. J....................May 21, 1912
Superintendent, Little Rock Gas and Fuel Company, 113 West Sixth Street, Little Rock, Arkansas.

Gilbert, A. J....................May 16, 1916
Foreman, Arkansas Natural Gas Company, Malvern, Arkansas.

Gill, John E....................May 16, 1916
President, Manufacturers Light & Heat Company, 310 Columbia Bank Building, Pittsburgh, Pennsylvania.

Gilmore, Frank M....................May 21, 1907
Secretary-Manager, Mound Valley Natural Gas & Oil Company, Mound Valley, Kansas.

Gindele, Albert H....................May 18, 1915
Industrial Gas Engineer, Toledo Railway & Light Company, 1120 Norwood Avenue, Toledo, Ohio.

Given, E. E....................May 18, 1915
Field Superintendent, The East Ohio Gas Company, 1447 East Sixth Street, Cleveland, Ohio.

Glasgow, Arthur Graham....................May 21, 1912
Chairman, Humphreys & Glasgow, Ltd., 36 and 38 Victoria Street, London, S. W., England.

Glass, John....................May 16, 1911
Chief Engineer, Carnegie Natural Gas Company, 245 North Bridge Street, Waynesburg, Pennsylvania.

Glass, Roy....................May 16, 1916
Engineer, Carnegie Natural Gas Company, Hastings, West Virginia.

Gleason, C. W....................May 20, 1913
Division Engineer, United Natural Gas Company, 507 North Street, Oil City, Pennsylvania.

Goff, George S....................May 17, 1910
General Manager, Crystal Gas Company, 26 East Market Street, Corning, New York.

Goldsborough, J. R....................May 19, 1914
Titusville Supply Company, 1520 Farmers Bank Building, Pittsburgh, Pennsylvania.

Goodnow, Robert W....................May 21, 1912
City Gas Inspector, City of Kansas City, City Hall, Kansas City, Missouri.

Goodrich, H. B....................May 17, 1910
Consulting Geologist, 450 West 147th Street, New York, New York.

Grace, Clarence H.................................May 16, 1916
Manager, Gas Journal Publishers, Limited, Hamilton, Ontario, Canada.

Graffis, W. H.......................................May 20, 1913
Publisher (President), Gas Publishing Company (The Gas Record), 347 Monadnock Block, Chicago, Illinois.

Graham, Lyman L.................................May 20, 1913
Secretary, United Natural Gas Company, 206 Seneca Street, Oil City, Pennsylvania.

Grammel, B. J.......................................May 18, 1915
Purchasing Agent, Iroquois Natural Gas Company, 45 Church Street, Buffalo, New York.

Grant, C. E..May 18, 1915
Agent, Pennsylvania Fuel Supply Company, 416 Main Street, Emlenton, Pennsylvania.

Gray, A. R..May 16, 1916
Assistant General Superintendent, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Gray, Homer R.......................................May 20, 1913
Assistant Treasurer, Iroquois Natural Gas Company, Iroquois Building, Buffalo, New York.

Gray, J. F...May 20, 1913
Engineer, Department, The East Ohio Gas Company, 1447 East Sixth Street, Cleveland, Ohio.

Grear, W. S...May 19, 1908
District Superintendent, Welsbach Street Lighting Company of America, Peoples Gas Building, Chicago, Illinois.

Greenawalt, E. J.....................................May 18, 1915
Trunk Line Foreman, Columbia Gas & Electric Company, 1206 Jefferson Avenue, Huntington, West Virginia.

Greis, Harry N..May 21, 1912
Gas Expert, Drew Building, Tulsa, Oklahoma.

Griswold, Robert G.................................May 18, 1915
Engineer, Henry L. Doherty & Company, 60 Wall Street, New York, New York.

Griswold, William T................................May 16, 1911
Geologist, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Groble, J. C...May 16, 1916
Assistant Manager, Reynolds Gas Reg. Company, Anderson, Indiana.

Grosscup, Fred Paul................................May 18, 1915
President, Charleston-Dunbar Natural Gas Company, Charleston, West Virginia.

Grosscup, Paul B.....................................May 18, 1915
Vice-President and General Manager, Charleston-Dunbar Natural Gas Company, Charleston, West Virginia.

Guffey, Joseph F.....................................May 16, 1911
General Manager, The Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Gurnsey, W. M..May 18, 1909
Superintendent, Crystal City Gas Company, 26 East Market Street, Corning, New York.

Guitteau, W. S..May 18, 1915
Sales Manager, Lloyd Construction Company, 860 Greenwood Avenue, Detroit, Michigan.

Gwynn, E. F..May 18, 1909
President, Gwynn Gas Burner & Engineering Company, 713 Empire Building, Pittsburgh, Pennsylvania.

Hackstaff, John D....................................June 12, 1906
General Manager, Southern California Gas Company, 805 Garland Building, Los Angeles, California.

Hadley, F. L..May 16, 1911
Superintendent of Lines, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Hadley, W. R..May 19, 1908
Secretary-Treasurer, The Union Natural Gas Corporation, 1608 Union Bank Building, Pittsburgh, Pennsylvania.

Hagen, O. C...May 16, 1916
General Manager, Drilling Department, Ohio Fuel Supply Company, 75 Huffman Avenue, Columbus, Ohio.

Hagan, W. G...May 18, 1915
Mechanical Engineer, The East Ohio Gas Company, 7918 Hough Avenue, Cleveland, Ohio.

Hall, C. T..May 16, 1911
Oil and Gas Operator, Bula Oil Company, 74 Vandergrast Building, Pittsburgh, Pennsylvania.

Hall, Herman H..May 16, 1916
Agent, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Hall, Jesse J...May 16, 1916
Accountant, Randall Gas Company, 190 Chancery Row, Morgantown, West Virginia.

Hall, W. W..May 16, 1911
Manager of Sales, Republic Iron and Steel Company, 1743 Oliver Building, Pittsburgh, Pennsylvania.

Hamilton, W. R..May 18, 1915
General Manager, Montebello Oil Company, 433 California Street, San Francisco, California.

Hanchett, F. C..May 16, 1916
Foreman, United Natural Gas Company, 329 West Walnut Street, Titusville, Pennsylvania.

Hanks, J. G...May 20, 1913
Superintendent, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Hann, Thomas D..May 16, 1911
General Manager, Greensboro Gas Company, Brownsville, Pennsylvania.

Hannan, Robert W......................................May 16, 1911
Oil and Gas Producer, 76-78 Vandergrift Building, Pittsburgh, Pennsylvania.

Hare, A. S..May 18, 1915
Cashier, The Natural Gas Company of West Virginia, 1226 Chaplin Street, Wheeling, West Virginia.

Hare, C. Willing......................................May 17, 1910
Manager, New Business Department, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Harrington, D. P......................................May 19, 1914
Assistant to General Superintendent, The Texas Company, Natural Gas Department, P. O. Drawer 983, Fort Worth, Texas.

Harris, George S.......................................May 20, 1913
Chief Bookkeeper, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Hartzell, A. C.......................................May 19, 1908
Treasurer, Greenville Natural Gas Company, Canal Street, Greenville, Pennsylvania.

Harwood, J. Arch.......................................May 18, 1915
Civil Engineer, The Natural Gas Company of West Virginia, 41 Vine Street, Salem, Ohio.

Hastings, John ....May 16, 1916
Foreman, Iroquois Natural Gas Company, Hamburg, New York.

Hastings, William ....May 20, 1913
Superintendent, Iroquois Natural Gas Company, 37 Church Street, Buffalo, New York.

Hatfield, J. S.......................................May 19, 1914
Assistant Superintendent, Killbuck & Millersburg Oil & Gas Company, Millersburg, Ohio.

Hawkins, B. L.......................................May 16, 1916
Auditor, Eastern Oil Company, 312 Fidelity Building, Buffalo, New York.

Hay, Ralph W.......................................May 18, 1909
Assistant General Superintendent, Manufacturers Light & Heat Company, 248 Fourth Avenue, Pittsburgh, Pennsylvania.

Haymaker, F. B.......................................May 18, 1915
Treasurer, The Producers Gas Company, 316 Main Street, Clarksburg, West Virginia.

Haymond, E. L.......................................May 18, 1915
General Manager, Haymond Company, 103 South Mulberry Street, Muncie, Indiana.

Hays, Victor A.......................................May 21, 1907
General Auditor, Kansas Natural Gas Company, Sixth and Maple Streets, Independence, Kansas.

Hazeltine, Roy S.......................................May 16, 1916
Assistant Chief Geologist, Continental Oil and Gas Company, Box 578, Bartlesville, Oklahoma.

Hazlett, P. S.......................................May 16, 1916
Foreman, Hope Natural Gas Company, West Union, West Virginia.

Hazlett, Ira I.......................................May 16, 1916
Secretary, Jackson Pike Oil & Gas Company, New Lexington, Ohio.

Healey, F. R.......................................May 18, 1915
Superintendent, Electrical Distribution, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Healy, J. H.......................................May 16, 1916
Assistant Treasurer, Potter Gas Company, Farmers Bank Building, Pittsburgh, Pennsylvania.

Heard, T. J.......................................May 18, 1915
Secretary-Treasurer, Reserve Natural Gas Company, P. O. Box 191 Shreveport, Louisiana.

Heasley, Harry ....May 16, 1916
President, Oklahoma Fuel Supply Company, 11½ Main Street, Tulsa, Oklahoma.

Heath, C. R.......................................May 19, 1908
President, Middletown Gas Company, Middletown, Indiana.

Heazlett, Frank .... May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Blairsville, Pennsylvania.

Heazlett, William .... May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Latrobe, Pennsylvania.

Heck, A. S .... May 18, 1915
Manager, Goff and Heck, Spencer, West Virginia.

Heeter, C. M .... May 16, 1916
President, C. M. Heeter Sons & Company, Inc., Duff City Gas Company, North Lima Gas Company, 251 South McKane Street, Boiler, Pennsylvania.

Hegerty, F. P .... May 16, 1911
Representative, Westinghouse Electric & Manufacturing Company, 1808 Union Bank Building, Pittsburgh Pennsylvania.

Heggem, Alf. G .... May 16, 1916
Petroleum Engineer, Consulting, 512-513 Daniel Building, Tulsa, Oklahoma.

Helm, Charles L .... May 20, 1913
Agent, The East Ohio Gas Company, 137 Public Square, Wooster, Ohio.

Henderson, James Alexander Leo .... May 16, 1911
Director and Technical Adviser, New Brunswick Gas & Oil Fields Company, Limited, 3 London Wall Building, London, E. C., England.

Henderson, John I .... May 16, 1916
Engineer, The Logan Natural Gas Company, 34 Ruggery Building, Columbus, Ohio.

Hennessy, George F .... May 16, 1916
United Fuel Gas Company, 1810 McClung Street, Charleston, West Virginia.

Henning, M. H .... May 18, 1915
Superintendent, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Herr, J. P .... May 16, 1916
Advertising Manager, Tulsa Daily World, Tulsa, Oklahoma.

Heuperman, F. J .... May 18, 1915
Engineer, Calgary Gas Company, Limited, 215 Sixth Avenue, West, Calgary, Alberta, Canada.

Heydrick, James C .... May 16, 1916
Leasing Department, United Fuel Gas Company, Charleston, West Virginia.

Hickstein, Ernest O .... May 19, 1914
Mechanical Engineer, Quapaw Gas Company, Bartlesville, Oklahoma.

Higgins, W. C .... May 20, 1913
Manager, Contract Department, The East Ohio Gas Company, East Ohio Gas Building, Cleveland, Ohio.

Higgins, W. C .... May 16, 1911
Editor and Publisher, Oil and Gas, 1803 Fifth Avenue, Pittsburgh, Pennsylvania.

Hildabrand, J. S .... May 16, 1916
Field Superintendent, South Hills Oil & Gas Company, R. F. D. No. 1, Fair Haven, Pennsylvania.

Hildebrand, H. D. .... May 19, 1914
President, Hammon Coupler Company, 819 Farmers Bank Building, Pittsburgh, Pennsylvania.

Hill, Charles E..May 18, 1915
Superintendent, Alden-Batavia Natural Gas Company, 71 Main Street, Batavia, New York.

Hill, Dudley M..May 16, 1916
Assistant to Mechanical Engineer, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Hill, J. B..May 16, 1911
Manager, Welsbach Company, 621 Liberty Avenue, Pittsburgh, Pennsylvania.

Hill, W. W..May 19, 1914
Acting Chief Engineer, Quapaw Gas Company, Bartlesville, Oklahoma.

Hilty, John..May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Altoona, Pennsylvania.

Hinchey, W. T..May 19, 1914
Inspector, Kansas Natural Gas Company, Pittsburgh, Kansas.

Hinerman, George L..May 19, 1914
Division Superintendent, Philadelphia Company of West Virginia, Weston, West Virginia.

Hinshaw, E. M..May 17, 1910
Owner of Controlling Interest, Olney Gas Company, Sumner Gas Company, Illinois, 18 North Meridian Street, Indianapolis, Indiana.

Hitchcock, Otto G..May 18, 1909
Secretary and General Manager, Hays Manufacturing Company, 12th and Liberty Streets, Erie, Pennsylvania.

Hoagland, H. C..May 17, 1910
General Manager, Muskogee Gas & Electric Company, Muskogee, Oklahoma.

Hogg, Herman B..May 18, 1915
District Manager, National Supply Company, Parkersburg, West Virginia.

Holbrook, David Oliver..May 19, 1908
Vice-President, The Dayton Pipe Coupling Company, 904 Oliver Building, Pittsburgh, Pennsylvania.

Holbrook, Lynn ....May 20, 1913
Purchasing Agent, The United Natural Gas Company, 308 Seneca Street, Oil City, Pennsylvania.

Holman, C. L..May 21, 1912
President and General Manager, The Laclede Gas Light Company, 716 Locust Street, Saint Louis, Missouri.

Holmes, A. G..June 12, 1906
Vice President and Manager, Pittsburgh Meter Company, P. O. Box 252, East Pittsburgh, Pennsylvania.

Holtz, W. H..May 20, 1913
Chief Clerk, General Office, The East Ohio Gas Company, 1447 East Sixth Street, Cleveland, Ohio.

Hoover, H. J..May 20, 1913
Commercial Manager, Gas Department, The Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Hoover, Rex ....May 19, 1914
Division Superintendent, Wichita Natural Gas Company, Beaver Building, Wichita, Kansas.

Hopp, Henry O..........May 16, 1911
Manager, Malta and McConnellsville Gas Company, Malta, Ohio.

Horner, Boyd E..........May 16, 1911
Superintendent, Eagle District Gas Company, 453 West Pike Street, Clarksburg, West Virginia.

Horner, Lynn S..........May 16, 1911
Superintendent, Washington Gas Company, Horner Building, Clarksburg, West Virginia.

Horsley, George H..........May 16, 1916
Purchasing Agent, East Ohio Gas Company, 1290 West 103rd Street, Cleveland, Ohio.

Horton, F. J..........May 19, 1908
General Manager, Portland Gas & Pipe Line Company, 402 South Elm Street, Iola, Kansas.

Hottinger, R. L..........May 18, 1909
Meter Repairer, Logan Natural Gas & Fuel Company, 534 Second Street, Fremont, Ohio.

Hottle, A. G..........May 16, 1916
Superintendent, Arco Oil Company, South Street, Wooster, Wayne County, Ohio.

Hovis, Park..........May 16, 1916
Gas Well Driller and Inventor, Wooster, Ohio.

Hovis, W. H..........May 16, 1916
Foreman, United Natural Gas Company, Clermont, Pennsylvania.

Howard, G. E..........May 18, 1915
Master Mechanic, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Howard, R. B..........May 16, 1916
Agent, Hope Natural Gas Company, 17 Clarksburg Street, Mannington, West Virginia.

Howe, Willard..........May 19, 1914
Sales Department, National Transit Company, Oil City, Pennsylvania.

Howard, James H..........May 21, 1912
Superintendent Border Gas Company, 1206 Matamoras Street, Laredo, Texas.

Howe, J. C..........May 19, 1914
Manager, Bartlesville Gas & Oil Company, 507 Cherokee Avenue, Bartlesville, Oklahoma.

Hoyt, H. J..........May 18, 1909
Representative, Metric Metal Works, 2114 Farmers Bank Building, Pittsburgh, Pennsylvania.

Hoyte, Walter S..........May 21, 1907
First Vice-President and General Manager, Wichita Natural Gas Company, Suite 727 Beacon Building, Wichita, Kansas.

Huff, C. F..........May 20, 1913
Superintendent, The Clarion Gas Company, Clarion, Pennsylvania.

Hughes, William K..........May 21, 1912
Vice President, The Continental Supply Company, 918 Third National Bank Building, St. Louis, Missouri.

Hull, H. D..........May 18, 1915
Field Superintendent, Medina Gas & Fuel Company, Ashland, Ohio.

Humphreys, Alexander C..............................May 21, 1912
President, Stevens Institute of Technology, Buffalo Gas Company, and Humphreys & Miller, Inc., 165 Broadway, New York, New York.

Hunt, Nile..............................May 16, 1916
Engineer, The Manufacturers Light & Heat Company, Hundred, West Virginia.

Hunter, Campbell M..............................May 20, 1913
Oil Mining Expert, Thomas & Hunter, 3 Lambard Street, London, E. C., England.

Hunter, J. W..............................May 16, 1916
Agent, The Manufacturers Light & Heat Company, Rochester, Pennsylvania.

Hurlburt, Alfred..............................May 16, 1911
Engineer, Kansas City Gas Company, 910 Grand Avenue, Kansas City, Missouri.

Hutchinson, Frank R..............................May 20, 1911
Sales Manager, The Gas Appliance Company, 713 Frankfort Avenue, West, Cleveland, Ohio.

Hutchinson, H. D..............................May 16, 1911
Contractor, 60 Lincoln Street, Uniontown, Pennsylvania.

Hutchinson, J. E..............................May 16, 1916
Auditor, Lone Star Gas Company, Praetoriam Building, Dallas, Texas.

Hutchinson, W. P..............................May 18, 1915
Vice President and Sales Manager, The Sprague Meter Company, Bridgeport, Conn.

Hutchinson, E H..............................May 18, 1915
Producer & Contractor, Harmony, Pennsylvania.

Ikard, L. D..............................May 16, 1916
Field Foreman, Columbus Producing Company, Miami, West Virginia.

Inghram, D. W..............................May 16, 1916
Field Foreman, The Peoples Natural Gas Company, Burgettstown, Pennsylvania.

Irwin, J. W..............................May 16, 1916
Manager, Ohio Pipe & Supply Company, West Park, Ohio.

Ivory, E. D..............................May 16, 1916
Industrial Department, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Jackson, Frank G..............................May 20, 1913
Chief Station Engineer, United Natural Gas Company, R. F. D. No. 1, Hallton, Elk County, Pennsylvania.

Jackson, G. H..............................May 16, 1916
Gas Department, Monongahela Valley Traction Company, Fairmont, West Virginia.

Jacobs, P. C..............................May 16, 1911
Superintendent, Ohio Gas Meter Company, 2355 Lakeside Avenue, Cleveland, Ohio.

James, D. K..............................May 20, 1913
Sales Manager, American Railway Appliance Company, 105 West Third Street, Oil City, Pennsylvania.

James, Robert C..............................May 17, 1910
General Auditor, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Jarvies, T. B..........May 19, 1908
Secretary, Jarvies Gas Burner, Heating & Plumbing Company, 4022 Belleview Avenue, Kansas City, Missouri.

Jay, C. H..........May 16, 1916
General Auditor, Ohio Cities Gas Company, 135 North Front Street, Columbus, Ohio.

Jay, D. C..........May 18, 1915
Superintendent, Leasing Department, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Jenkins, Howard..........May 16, 1916
Chief Engineer, Hope Natural Gas Company, Hardy Apartments, Mechanic Street, Clarksburg, West Virginia.

Jewett, W. S..........May 16, 1916
Foreman, The Manufacturers Light & Heat Company, McKees Rocks, Pennsylvania.

Jimerson, Deo..........May 18, 1915
Chief Engineer, Columbia Gas & Electric Company, R. F. D. No. 1, Kenova, West Virginia.

Johnson, Roswell H..........May 16, 1916
Consulting Geologist, Johnson & Huntley, 1039 Murrayhill Avenue, Pittsburgh, Pennsylvania.

Johnson, Russell A..........May 20, 1913
Purchasing Agent, Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Jolliffe, R. Dale..........May 16, 1916
Agent, The Manufacturers Light & Heat Company, Bellevue, Pennsylvania.

Jones, Clement Ross..........May 16, 1916
Consulting Engineer, Randall Gas Company, Morgantown, West Virginia.

Jones, George H..........May 20, 1913
Comptroller, East Ohio Gas Company, 26 Broadway, New York, New York.

Jones, Hoyle..........May 18, 1915
Manager of Sales, La Belle Iron Works, 605 R. A. Long Building, Kansas City, Missouri.

Jones, Hugh T..........May 21, 1912
Jones Gas Company, 225 West Main Street, Chanute, Kansas.

Jones, T. C..........June 12, 1906
President, The Delaware Gas Company, 68 North Sandusky Street, Delaware Ohio.

Jones, Thomas J..........May 16, 1916
Superintendent, Hope Natural Gas Company, 330 Locust Street, Mannington, West Virginia.

Jones, T. J..........May 18, 1915
Manager, The Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Jordan, E. W..........May 21, 1912
Gas Engineer, Bessemer Gas Engine Company, Grove City, Pennsylvania.

Jordan, George E..........May 18, 1915
Engineer, Louisiana Gas Company, Mooringsport, Louisiana.

Jordan, G. R..........May 18, 1915
Civil Engineer, Southwestern Gas & Electric Company, 116 Texas Street, Shreveport, Louisiana.

Judge, W. J .... May 20, 1913
Vice President, National Fuel Gas Company, 26 Broadway, New York, New York.

Kanitz, Jacques .... May 19, 1914
Generaldirector, der Ungarischen Gasglühlicht A. G., VI., Vaczikorult 3, Budapest, Hungary.

Katona, Louis .... May 20, 1913
Consulting Engineer, I Bors utca. 16, Budapest, Hungary.

Kay, J. M .... May 16, 1916
Field Superintendent, Glenshaw Natural Gas Company, Glenshaw, Pensylvania.

Keenan, J. E .... May 16, 1916
District Foreman, Equitable Gas Company, 6306 Penn Avenue, Pittsburgh, Pennsylvania.

Kellogg, Franklin L .... May 16, 1911
Field Manager, Ontorio Gas Company, Honeoye Falls, New York.

Kellum, Benj. J .... June 12, 1906
Manager, Western Department, Welsbach Company, 141 North Wabash Avenue, Chicago, Illinois.

Kelly, J. W .... May 16, 1911
Salesman, Jarecki Manufacturing Company, 311 First Avenue, Pittsburgh, Pennsylvania.

Kenney, A. E .... May 16, 1916
President, Kenney Land & Oil Company, Box 564, Parkersburg, West Virginia.

Kennedy, J. J .... May 16, 1911
General Manager of Sales, National Tube Company, Frick Building, Pittsburgh, Pennsylvania.

Kent, J. F .... May 18, 1915
President, Pelham Oil & Gas Company, Huntington, West Virginia.

Kerr, Peter M .... May 16, 1916
Superintendent of Drilling, T. W. Phillips Gas & Oil Company, 613 Woodward Avenue, Kittanning, Pennsylvania.

Kerr, T. H .... May 18, 1915
Engineer, Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Ketchum, D. A .... May 18, 1915
Assistant General Superintendent, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Ketler, W. G .... May 16, 1916
Agent, The Peoples Natural Gas Company, Wilkinsburg, Pennsylvania.

Kidd, J. W .... May 16, 1916
Chief Clerk, Hope Natural Gas Company, 477 Campbell Street, Wilkinsburg, Pennsylvania.

Kidner, R. L .... March 20, 1906
Manager, Century Stove & Manufacturing Company, 1223-25 West Tenth Street, Kansas City, Missouri.

Kightlinger, A. D .... May 16, 1916
Field Foreman, The Manufacturers Light & Heat Company, Washington, Pennsylvania.

Kilpatrick, R. B .... May 18, 1915
Superintendent, Windsor Gas Company, 202 Ouellette Avenue, Windsor, Ontario, Canada.

Kimmell, C. F..May 16, 1916
Division Superintendent, Manufacturers Gas Company, Marlin Building, Brookville, Pennsylvania.

Kincheloe, L. G..May 16, 1916
Foreman, Hope Natural Gas Company, 319 St. Clair Avenue, Clarksburg, West Virginia.

King, E. J..May 18, 1915
Assistant to President, The Huntington Development & Gas Company, 928 Third Avenue, Huntington, West Virginia.

King, Jas. ....May 16, 1916
Superintendent, Allegheny Heating Company, 603 Burd Street, North Side, Pittsburgh, Pennsylvania.

King, W. S..May 16, 1916
Field Foreman, The Peoples Natural Gas Company, Murraysville, Pennsylvania.

Kingsley, T. C..May 16, 1916
Oil Producer, Kingsley & Burgess, Middlebourne, West Virginia.

Kinley, George A..May 16, 1916
Stenographer, Hope Natural Gas Company, 1130 Ross Avenue, Wilkinsburg, Pennsylvania.

Kirk, F. W..May 21, 1912
Superintendent Pipe Lines, Lone Star Gas Company, 807 First National Bank Building, Fort Worth, Texas.

Kitchen, J. W..May 20, 1913
Assistant Secretary and Treasurer, Pennsylvania Gas Company, Warren, Pennsylvania.

Kline, Virgil P., Jr..May 20, 1913
Assistant to Superintendent, Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Klingensmith, J. M..May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Greensburg, Pennsylvania.

Klise, John J..May 16, 1916
The Klise, Eckstein, McCann Company, Lancaster, Ohio.

Klug, N. J..May 16, 1916
Field Clerk, The Manufacturers Light & Heat Company, Proctor, West Virginia.

Klumpp, John Bartleman..May 19, 1916
Inspecting Engineer, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Knapp, Frank H..May 16, 1916
General Manager, Pittsburgh Water Heater Company, Pittsburgh, Pennsylvania.

Knapp, Isaac N..May 21. 1912
116 Ardmore Avenue, Ardmore, Pennsylvania.

Knepshield, Charles ....May 16, 1916
Field Superintendent, American Natural Gas Company, Leechburg, Pennsylvania.

Knight, William H..May 19, 1908
General Manager, Cleveland Gas Meter Company, 2180 East 65th Street, Cleveland, Ohio.

Knowles, W. R..May 16, 1916
Superintendent Pressure Department, The East Ohio Gas Company, 10832 Greenlawn Avenue, Cleveland, Ohio.

Koontz, L. V..May 18, 1915
President, Koontz Oil & Gas Company, Clendenin, West Virginia.

Krause, Charles .... May 20, 1913
Inspector, The Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Krebs, Oscar .... May 18, 1915
Main Line Foreman, Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Krick, Kay C .... February 27, 1906
Special Agent, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Lackey, Frank .... May 18, 1915
Superintendent, Crescent Oil & Gas Company, Glenwillard, Pennsylvania.

Ladd, George T .... May 16, 1911
Chairman, Executive Board, Tri-County Gas Company, 1620 Farmers Bank Building, Pittsburgh, Pennsylvania.

LaDow, B. E .... May 19, 1908
President and General Manager, Fredonia Gas Company, Fredonia, Kansas.

LaDow, C. V .... May 17, 1910
Local Manager, Fredonia Gas Company, Fredonia, Kansas.

Lakamp, J. H .... May 20, 1913
General Superintendent, Operating Department, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Lambing, J. A .... May 18, 1909
1023 Franklin Avenue, Wilkinsburg, Pennsylvania.

Landis, H. K .... May 16, 1916
Managing Editor, 52 Vanderbilt Avenue, New York, New York.

Lansley, John W .... May 18, 1915
Secretary, Southwestern Gas & Electric Company, 1615 Harris Trust Building, Chicago, Illinois.

Larkin, J. J .... May 17, 1910
Larkin Brothers, Bartlesville, Oklahoma.

Larkin, W. H .... May 18, 1909
Manager, Larkin & Company, Butler, Pennsylvania.

Lathrop, Alanson P .... May 17, 1910
President, American Light & Traction Company, The Equitable Building, 120 Broadway, New York, New York.

Lavell, Lon .... May 16, 1916
Foreman, Hope Natural Gas Company, Fairview, West Virginia.

Law, C. H .... May 16, 1911
General Superintendent, Ridgway Light & Heat Company, 16 North Broad, Ridgway, Pennsylvania.

Lawrence, Charles A .... May 16, 1911
Secretary-Treasurer, Tri-County Natural Gas Company, Benedum-Trees Building, Pittsburgh, Pennsylvania.

Layton, Miles B .... May 16, 1911
Assistant Manager, Manufacturers Light & Heat Company, 312 Columbia Bank Building, Pittsburgh, Pennsylvania.

Leamy, Alan .... May 18, 1909
Manager, Middle West Department, Welsbach Company, 116-122 East Chestnut Street, Columbus, Ohio.

Leard, R. C .... May 18, 1915
Superintendent, United Fuel Gas Company, Kermit, West Virginia.

Leathers, J. H .... May 16, 1916
Foreman, Equitable Gas Company, Donora, Pennsylvania.

Lee, Thomas M..May 20, 1913
Superintendent, Trunk Lines, The East Ohio Gas Company, Canton, Ohio.

Leet, William G..May 21, 1912
Superintendent, Gas Department, Southwestern Gas and Electric Company, 116 Texas Street, Shreveport, Louisiana.

LeFevre, Harry E..May 17, 1910
Contractor and Stockholder, American Natural Gas Company, Lexington Avenue and Fourth Street, Aspinwall, Pennsylvania.

Lehman, I. L..May 16, 1916
Commercial Manager, The Dayton Gas Company, Dayton, Ohio.

Leidicker, F. H..May 16, 1916
Leidicker Tool Company, Marietta, Ohio.

Leight, Anthony..May 16, 1916
Field Superintendent, American Natural Gas Company, Glenshaw, Pennsylvania.

Leight, Harry G..May 16, 1916
Foreman, Meter Repair Department, Logan Natural Gas & Fuel Company, Mansfield, Ohio.

Leist, S. E..May 18, 1915
Clerk, Columbia Gas & Electric Company, Branchland, West Virginia.

Leland, Edward D..May 16, 1911
Superintendent, Compressing Stations, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Leonard, A. W..May 19, 1908
General Manager, Oklahoma Fuel Supply Company, 11½ South Main Street, Tulsa, Oklahoma.

Leonard, Charles F..May 20, 1913
Gas Engineer, Public Service Commission, 2nd District, Room 6, Lyon Block, Albany, New York.

Leonard, John..May 16, 1916
Field Superintendent, Manufacturers Gas Company, Kane, Pennsylvania.

Levy, F. A..May 19, 1914
Vice President, Gulf Pipe Line Company, Schenley Hotel, Pittsburgh, Pennsylvania.

Lepper, E. L..May 16, 1916
Agent, Logan Natural Gas & Fuel Company, Fostoria, Ohio.

LeVier, C. P..May 16, 1916
The Manufacturers Light & Heat Company, Waynesburg, Pennsylvania.

Lewis, A. H..May 20, 1913
Agent, Fremont Gas, Electric Light & Power Company, Fremont, Ohio.

Lewis, Phil..May 16, 1911
Foreman, The East Ohio Gas Company, 240 North Second Street, Cuyahoga Falls, Ohio.

Lewis, T. L..May 21, 1912
Assistant Manager of Sales, A. M. Byers Company, 235 Water Street, Pittsburgh, Pennsylvania.

Light, George..May 18, 1915
Superintendent, Dayton Gas Company, 235 North St. Clair, Dayton, Ohio.

Lillie, Lewis .... May 21, 1907
Third Vice President and Treasurer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Lindsay, Robert J .... May 18, 1909
Assistant Secretary-Treasurer, Hope Engineering & Supply Company, 411 Pioneer Building, Tulsa, Oklahoma.

Lindsay, W. R .... May 16, 1916
Sales Agent, Byers Pipe Company, Tulsa, Oklahoma.

Little, William .... May 20, 1913
District Foreman, The Texas Company, Moran, Texas.

Lockhart, Robert .... May 16, 1916
Ohio Fuel Oil Company, Charleston, West Virginia.

Lockwood, W. H .... May 16, 1916
Assistant Foreman, The Manufacturers Light & Heat Company, Bellaire, Ohio.

Loebell, Henry O .... May 16, 1916
Industrial Fuel Engineer, Henry L. Doherty & Company, 60 Wall Street, New York, New York.

Logue, James J .... May 16, 1916
Superintendent, Reserve Gas Company, 241 North River Avenue, Weston, West Virginia.

Lloyd, Thomas E. C .... March 20, 1906
Shop Foreman, Wyandotte County Gas Company, 1236 Central Avenue, Kansas City, Kansas.

Lohr, G. C .... May 18, 1915
Agent, The East Ohio Gas Company, 37 Main Street, Warren, Ohio.

Long, W. A .... May 16, 1916
Foreman, Arkansas Natural Gas Company, Vivian, Louisiana.

Longenecker, W. C .... May 16, 1911
Treasurer, Toledo Pipe Threading Machine Company, 1445 Summit Street, Toledo, Ohio.

Lord, R. S .... May 18, 1909
Vice President and Treasurer, Hope Engineering & Supply Company, Mount Vernon, Ohio.

Louis, Frank I .... May 21, 1912
Dist. Manager, The National Supply Company of Kansas, 506 South Elwood Avenue, Tulsa, Oklahoma.

Loveland, Elmer .... May 18, 1909
Superintendent, Logan Natural Gas & Fuel Company, 511 Sandusky Avenue, Fremont, Ohio.

Lowry, Frank M .... May 18, 1915
Vice President, Dominion Natural Gas Company, 842 Moine Bank Building, Buffalo, New York.

Lupher, Preston W .... May 18, 1908
Vice-President and General Manager, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Luther, George .... May 16, 1916
Foreman, The Manufacturers Light & Heat Company, Moundsville, West Virginia.

Lyon, J. F .... May 16, 1916
Meter Inspector, T. W. Phillips Gas and Oil Company, Butler, Pennsylvania.

Lynn, James T .... May 21, 1907
President, National Gas, Electric Light & Power Company, 1714 Ford Building, Detroit, Michigan.

Lyon, M. P..May 18, 1915
Oil and Gas Broker, Hotel Tulsa, Tulsa, Oklahoma.

Lytle, M. E..May 16, 1911
Superintendent, The Ohio Fuel Supply Company, 977 Bryden Road, Columbus, Ohio.

Lytle, V. H..May 16, 1916
Traveling Salesman, American Manufacturing Company of Brooklyn, New York, 433 Front Street, Marietta, Ohio.

Macbeth, Alexander B..May 21, 1907
Vice President and General Manager, Southern California Gas Company, 805 Garland Building, Los Angeles, California.

Magrew, B. A..May 16, 1916
Engineer, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Mahan, G. F..May 21, 1907
Vice President, National Supply Company of Kansas, Independence, Kansas.

Mallory, L. E..May 21, 1912
Oil and Gas Business, L. E. Mallory & Son, Bradford, Pennsylvania.

Manley, H. E..May 20, 1913
Clerk, Magnolia Petroleum Company, 2805 Swiss Avenue, Dallas, Texas.

Manning, William E..May 16, 1911
General Manager of Sales, Youngstown Sheet & Tube Company, Stambaugh Building, Youngstown, Ohio,

Mansfield, J. P..May 20, 1913
Superintendent, United Natural Gas Company, Van, Pennsylvania.

Markley, Joseph C..May 19, 1914
Treasurer, Southwestern Gas and Electric Company, 111 West Monroe, Chicago, Illinois.

Marple, M. R..May 16, 1916
Storekeeper, Equitable Gas Company, 23rd and Liberty Streets, Pittsburgh, Pennsylvania.

Martin, Edward P..May 20, 1913
Agent, The East Ohio Gas Company, Ravenna, Ohio.

Martin F. W..May 16, 1916
Agent, Hope Natural Gas Company, 302 Catherine Street, Sistersville, West Virginia.

Martin James ....May 20, 1913
Superintendent No. 2 Works, The East Ohio Gas Company, East 62nd Street and L. S. & M. S. R. R., Cleveland, Ohio.

Martin, J. O..May 16, 1916
Contracting Agent, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Martin, John ....May 20, 1913
President, Midway Gas Company, 332 Pine Street, Room 411, San Francisco, California.

Mascho, Charles W..May 20, 1913
Vice President, The National Supply Company, 136 Huron Street, Toledo, Ohio.

Mason, Alphonso ....May 18, 1909
Representative, Welsbach Company, Gloucester City, New Jersey.

Mason, C. F...May 21, 1907
Superintendent, The Western Distributing Company, Sedgwick, Kansas.

Mason, John F...May 20, 1913
Superintendent of Distribution, United Natural Gas Company, 308 Seneca Street, Oil City, Pennsylvania.

Mason, Sidney ....May 17, 1910
President, Welsbach Company, 412 United Gas Improvement Building, Broad and Arch Streets, Philadelphia, Pennsylvania.

Mathieu, Louis ....May 16, 1916
Agent, The Manufacturers Light & Heat Company, Toronto, Ohio.

Matson, J. R...May 20, 1913
Agent, The East Ohio Gas Company, 213 East Grant Street, Dennison, Ohio.

Maxon, Harry R...May 18, 1915
Assistant to General Manager, Central Indiana Gas Company, Muncie, Indiana.

Maxon, John H....May 18, 1909
President and General Manager, The Central Indiana Gas Company, 301 East Main Street, Muncie, Indiana.

May, A. G....May 16, 1916
217 Burris Street, Hamilton, Ontario, Canada.

Mayne, H. B....May 16, 1916
Assistant Foreman, The Manufacturers Light & Heat Company, Hundred, West Virginia.

McAllister, L. P.......................................May 18, 1915
Engineer, Columbia Gas & Electric Company, Branchland, West Virginia.

McBride, R. S....May 16, 1916
Associate Chemist, Bureau of Standards, Washington, District of Columbia.

McCabe, John G...May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, 1919 Forbes Street, Pittsburgh, Pennsylvania.

McCall, Edward P.......................................May 16, 1916
Drilling Contractor, C. W. McCall & Company, Second Street, Weston, West Virginia.

MoCalmont, C. P........................................May 20, 1913
Superintendent, Pennsylvania Gas Company, 213 Second Street, Warren Pennsylvania.

McCandless, C. H.......................................May 20, 1913
District Manager, United and Globe Rubber Manufacturing Companies, 914 Farmers Bank Building, Pittsburgh, Pennsylvania.

McClellan, Arthur ....May 16, 1916
Superintendent of Construction, Peoples Natural Gas Company, 108 Orchard Street, Woodlawn, Pennsylvania.

McClellan, Joseph ....May 16, 1916
Orifice Meter Department, Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

McClellan, W. C........................................May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Manor, Pennsylvania.

McClelland, J. Y..May 16, 1916
Assistant Foreman, The Manufacturers Light & Heat Company, Waynesburg, Pennsylvania.

McClintock, J. T..May 18, 1915
President, Huntington Development & Gas Company, 928 Third Avenue, Huntington, West Virginia.

McCloskey, James P....................................May 17, 1910
Superintendent, Columbia Gas & Electric Company, Tenth Street and Third Avenue, Huntington, West Virginia.

McCloy, S. D..May 16, 1916
Contractor, Any Company, 323 Ridge Avenue, Canonsburg, Pennsylvania.

McCloy, W. L..May 16, 1911
General Superintendent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

McCombs, W. A..May 18, 1915
Salesman, Powhatan Brass & Iron Works, Jenkins Arcade, Pittsburgh, Pennsylvania.

McConnell, H. H..May 16, 1916
Pennsylvania Gas Company, Warren, Pennsylvania.

McCord, J. W..May 18, 1909
Secretary and General Manager, Clintonian Fuel and Oil Company, 511 National Bank of Commerce Building, Columbus, Ohio.

McCrea, R. A..May 16, 1911
Construction Engineer, Pittsburgh Valve, Foundry & Construction Company, Box 1016, Pittsburgh, Pennsylvania.

McCormick, Edward P...................................May 16, 1916
Foreman, Iroquois Natural Gas Company, 37 Church Street, Buffalo, New York.

McCullough, G. W...May 16, 1916
Land Agent, Manufacturers Light & Heat Company, 513 Columbia Bank Building, Pittsburgh, Pennsylvania.

McCune, D. B..May 16, 1911
Agent, The Natural Gas Company of West Virginia, 34 Garfield Avenue, Salem, Ohio.

McCune, S. A..May 21, 1912
Field Superintendent, Arkansas Natural Gas Company, Box 94, Shreveport, Louisiana.

McCutcheon, Sam ....May 16, 1916
Field Superintendent, American Natural Gas Company, R. F. D. No. 2, Apollo, Pennsylvania.

McDermott, J. H..May 18, 1915
Vice President, Pentrass Natural Gas Company, Morgantown, West Virginia.

McDonald, Donald ....May 20, 1913
Vice President and General Manager, Louisville Gas & Electric Company, 311 West Chestnut Street, Louisville, Kentucky.

McDowell, Jesse Clark..............................February 27, 1906
President, Dominion Natural Gas Company, 820 Farmers Bank Building, Pittsburgh, Pennsylvania.

McFadden, W. H..May 21, 1912
President, Kay County Gas Company, Ponca City, Oklahoma.

McGee, W. F...May 16, 1916
Field Foreman, The Manufacturers Light & Heat Company, Canonsburg, Pennsylvania.

McGilvary, H. J..May 16, 1916
Foreman, Pittsburgh and West Virginia Gas Company, 150 High Street, Weston, West Virginia.

McIntyre, M..May 16, 1916
President and General Manager, Gowanda Natural Gas Company, 28 Main Street, Gowanda, New York.

McKay, C. R..May 18, 1915
Manager, Electrical Department, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

McIlhenny, John D..May 17, 1910
President, Gas Company of Montgomery County, (Norristown, Pa.) 1339 Cherry Street, Philadelphia, Pennsylvania.

McKee, George R..May 16, 1916
Foreman, Consolidated Gas Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

McKee, William..May 17, 1910
Secretary, The Chaplin-Fulton Manufacturing Company, 34 Penn Avenue, Pittsburgh, Pennsylvania.

McKenzie, William Hunter..........................February 27, 1906
General Manager, Wyandotte County Gas Company, Sixth and Main Avenue, Kansas City, Kansas.

McKibben, John F..May 19, 1914
Jarecki Manufacturing Company, 311 First Avenue, Pittsburgh, Pennsylvania.

McKnight, S. C..May 20, 1913
Agent, The East Ohio Gas Company, Barberton, Ohio.

McMahon, John..May 20, 1913
Collector, Iroquois Natural Gas Company, 75 Poma Avenue, Buffalo, New York.

McMahon, John B..May 18, 1915
Attorney, The Northwestern Ohio Gas Company, Spitzer Building, Toledo, Ohio.

McMahon, J. F..May 20, 1913
Manager and Treasurer, California Natural Gas Company, P. O. Box 500, Taft, California.

McMahon, John J..May 20, 1913
Superintendent Main Lines, The East Ohio Gas Company, Canton, Ohio.

McMahon, James W..May 18, 1909
General Manager, The North-Western Ohio Natural Gas Company, 210-212 Huron Street, Toledo, Ohio.

McMasters, W. C..May 16, 1916
Clerk, Pittsburgh, and West Virginia Gas Company, Clarksburg, West Virginia.

McMillan, John..May 20, 1913
Superintendent, The Portsmouth Gas Company, 802 Chillicothe Street, Portsmouth, Ohio.

McMillin, Emerson..May 17, 1910
Chairman, Board of Directors, American Light & Traction Company, 120 Broadway, New York, New York.

McMunn, J. S..May 16, 1916
District Foreman, Equitable Gas Company, Oakmont, Pennsylvania.

McNally, J. I..May 18, 1915
Electrolysis Expert, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

McNary, John B....................May 18, 1915
Manager, Canadian Meter Company, 88 and 90 Carolins Street, Hamilton, Ontario, Canada.

McNary, J. F....................May 19, 1914
Division Superintendent, Philadelphia Company of West Virginia, Union Bank Building, Clarksburg, West Virginia.

McNary, L. J....................May 16, 1916
Foreman, Reserve Gas Company, 343 North River Avenue, Weston, West Virginia.

McPeake, A. G....................May 16, 1916
Foreman, Manufacturers Light & Heat Company, 452 Ridge Avenue, Canonsburg, Pennsylvania.

Meals, S. W....................May 16, 1911
Division Superintendent, Carnegie Natural Gas Company, 320 Eighth Street, Moundsville, West Virginia.

Mead, Carl D....................May 16, 1916
Secretary-Treasurer, The Cadiz Gas Company, Cadiz, Ohio.

Mechesney, C. A....................May 16, 1916
Engineer, Equitable Gas Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Meredith, George B....................May 16, 1916
Foreman, Hope Natural Gas Company, Smithfield, West Virginia.

Mellon, Porter D....................May 20, 1913
Engineer, Calgary Gas Company, Limited, 215 Sixth Avenue, West, Calgary, Alberta, Canada.

Merket, Joseph ....May 18, 1915
Superintendent, The Texas Company, Natural Gas Department, Box 298, Moran, Texas.

Merrill, Edwin C....................May 21, 1912
Manufacturer, 2915 Smallman Street, Pittsburgh, Pennsylvania.

Mettler, Lee B....................June 12, 1906
Representative, American Water Heater Company, 317 Title Guaranty Building, Saint Louis, Missouri.

Metz, Eugene, Jr....................June 12, 1906
Representative, Metric Metal Works, 1003 Commerce Building, Kansas City, Missouri.

Meyer, Frank J....................May 16, 1916
Superintendent Gas Department, Oklahoma Gas & Electric Company, 12 North Broadway, Oklahoma City, Oklahoma.

Michel, F. M....................May 16, 1916
Foreman, United Natural Gas Company, 119 West Weber Avenue, DuBois, Pennsylvania.

Mickley, M. A....................May 18, 1909
Agent, The Marion Gas Company, 238 East Center Street, Marion, Ohio.

Miller, Alten S....................May 21, 1912
Vice President, Humphreys & Miller, Inc., 165 Broadway, New York, New York.

Miller, B. L....................May 18, 1915
United Natural Gas Company, Tidioute, Pennsylvania.

Miller, Carroll ....May 21, 1912
General Manager, Western United Gas & Electric Company, Aurora, Illinois.

Miller, E. S....................May 21, 1912
Superintendent Gas Department, Kansas Gas & Electric Company, 239 South Main Street, Wichita, Kansas.

Miller, Fred A..May 19, 1908
President and General Manager, S. R. Dresser Manufacturing Company, 54 Boyeston Street, Bradford, Pennsylvania.

Miller, H. G..May 18, 1915
Agent, The Granville Fuel & Light Company, P. O. Box 473, Granville, Ohio.

Miller, L. L..May 16, 1916
Foreman, Fayette County Gas Company, Walnut Street, Uniontown, Pennsylvania.

Miller, R. R..May 16, 1916
Chief Clerk, Allegheny Heating Company, 603 Burd Street, North Side, Pittsburgh, Pennsylvania.

Miller, William A..May 18, 1909
Engineer, National Chamber Oven Company, Cincinnati, Ohio.

Milne, D. S..May 18, 1915
Manager, Central Indiana Gas Company, Adams and Fifth Streets, Marion, Indiana.

Milne, W. E..May 18, 1915
Manager, Gainesville Gas & Electric Company, 12 South Rusk Street, Gainesville, Texas.

Miner, Fred W..May 18, 1909
Representative, The National Supply Company, 1306 Union Bank Building, Pittsburgh, Pennsylvania.

Mitchell, C. S..May 16, 1916
Controller, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Mitchell, J. Wylie..May 18, 1915
Superintendent of Distribution, St. Joseph Gas Company, 802 Frances Street, St. Joseph, Missouri.

Moeller, William, Jr..May 19, 1908
Chief Engineer, Midway Gas Company, P. O. Box 39, Taft, California.

Montgomery, J. H..May 18, 1915
The Natural Gas Company of West Virginia, 96 Garfield Avenue, Salem, Ohio.

Moore, Edgar M..May 18, 1915
Edgar M. Moore & Company, 809-810 Farmers Bank Building, Pittsburgh, Pennsylvania.

Moore, Harry ....May 16, 1916
Assistant Foreman, The Manufacturers Light & Heat Company, R. F. D. No. 1, Wallace, West Virginia.

Moore, Lee C..May 16, 1911
President, Lee C. Moore & Company, 341 Sixth Avenue, Pittsburgh, Pennsylvania.

Moran, P. A..May 16, 1916
District Foreman, Equitable Gas Company, 17th and Wharton Streets, Pittsburgh, Pennsylvania.

Morgan, W. J..May 16, 1911
Agent, East Ohio Gas Company, 404 Tuscarawas Street, West, Canton, Ohio.

Morris, Henry C..May 17, 1910
General Manager, The Dallas Gas Company, 1715 Commerce Street, Dallas, Texas.

Mueller, Fred B..June 12, 1906
Vice President, H. Mueller Manufacturing Company, Decatur, Illinois.

Morse, Nathan L. .... May 16, 1916
Purchasing Agent, Southern California Gas Company, 740 South Broadway, Los Angeles, California.

Mowrey, John .... May 16, 1916
Foreman, Hope Natural Gas Company, Clay Street, Clarksburg, West Virginia.

Mulkin, P. L. .... May 20, 1913
Agent, United Natural Gas Company, Meadville, Pennsylvania.

Munce, John Russell, ... May 16, 1911
Vice President and General Manager, Arkansas Natural Gas Company, 1115 State Bank Building, Little Rock, Arkansas.

Munro, Robert .... June 12, 1906
Vice President and General Manager, Century Stove and Manufacturing Company, Dupont Place and Park Avenue, Johnstown, Pennsylvania.

Munro, W. Lorne .... May 16, 1916
Auditor, Dominion Natural Gas Company, Main Street, Buffalo, New York.

Murdock, S. T. .... May 20, 1913
Managing Director, Indiana Gas & Electric Company, 1412 Merchants Bank Building, Indianapolis, Indiana.

Murray, John J. .... May 16, 1911
Superintendent City Division, Equitable Gas Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Murphy, F. C. .... May 16, 1916
Agent, The Manufacturers Light & Heat Company, Beaver Falls, Pennsylvania.

Murphy, S. F. .... May 16, 1916
Foreman, United Natural Gas Company, Halsey, Mt. Jewett P. O., Pennsylvania.

Murtaugh, James .... May 16, 1916
Field Superintendent, Ohio Fuel Supply Company, 760 East Main Street, Lancaster, Ohio.

Myers, E. E. .... May 16, 1916
Agent, The Peoples Natural Gas Company, New Kensington, Pennsylvania.

Nash, John J. .... May 18, 1915
General Manager, Huntington Development & Gas Company, 1428 Seventh Avenue, Huntington, West Virginia.

Nash, Raymond J. .... May 16, 1916
Foreman, Huntington Development & Gas Company, 928 Third Avenue, Huntington, West Virginia.

Near, W. W. .... May 19, 1914
President, Page-Hersey Iron, Tube & Land Company, Limited, 6603 Dominion Bank Building, Toronto, Ontario, Canada.

Neely, Ira L. .... May 16, 1916
Superintendent, The Medina Gas & Fuel Company, Mansfield, Ohio.

Neely, Lemon G. .... May 18, 1909
President, Medina Gas & Fuel Company, St. Marys, Ohio.

Nestor, J. F. .... May 16, 1916
Chief Engineer, Manufacturers Light & Heat Company, 1417 Chaplin Street, Wheeling, West Virginia.

Nestor, W. E. .... May 20, 1913
Engineer, Manufacturers Light & Heat Company, Waynesburg, Pennsylvania.

Newhouse, B. Frank..................................May 16, 1916
Service Clerk, Union Gas & Electric Company, Southwest Corner Fourth and Plum Streets, Cincinnati, Ohio.

Newman, A. J..May 16, 1916
General Auditor, Union Natural Gas Corporation, Union Bank Building, Pittsburgh, Pennsylvania.

Newton, George J....................................May 19, 1914
Meter Tester, Wichita Gas Company, 705 Jennings Avenue, Bartlesville, Oklahoma.

Newton, M. A...May 16, 1916
Assistant Industrial Engineer, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Newton, Nelson A.....................................May 18, 1915
Efficiency Engineer, The Logan Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Nicoll, Thomas ....May 19, 1914
Treasurer, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Nicholson, French ....May 16, 1916
Foreman, Hope Natural Gas Company, Bridgeport, West Virginia.

Nole, E. P..May 16, 1916
Field Foreman, The Peoples Natural Gas Company, Belle Vernon, Pennsylvania.

Norris, Henry S.......................................May 20, 1913
Secretary, Iroquois Natural Gas Company, Iroquois Building, Buffalo, New York.

Norris Rollin ....May 21, 1907
Superintendent of Works, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Northcott, G. A.......................................May 18, 1915
Treasurer, Huntington Development & Gas Company, 928 Third Avenue, Huntington, West Virginia.

Northrup, Charles S..................................May 18, 1915
Attorney, The Northwestern Ohio Natural Gas Company, Spitzer Building, Toledo, Ohio.

Norton, Charles L.....................................May 20, 1913
Manager, George C. Moon Company, Inc., 486 Arcade, Cleveland, Ohio.

Nutt, E. Burt...May 16, 1916
Auditor, Peoples Natural Gas Company, 421 Sixth Avenue, Pittsburgh, Pennsylvania.

Oakes, W. L..May 20, 1913
Chief Teller, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Oberfell, George G....................................May 16, 1916
Chemist, Ohio Fuel Supply Company, Homer, Ohio.

O'Brien, Thomas F....................................May 16, 1916
Agent, United Fuel Gas Company, Church Street, Spencer, West Virginia.

O'Brian, T. F...May 19, 1914
Superintendent, The Texas Company, Natural Gas Department, Drawer 44, Shreveport, Louisiana.

O'Brien, William ....May 19, 1914
President O'Brien Steel Construction Company, Washington, Pennsylvania.

O'Conner, T. M .... May 20, 1913
Foreman, The East Ohio Gas Company, 6411 Central Avenue, Cleveland, Ohio.

O'Day, John J .... May 16, 1916
Agent, The Manufacturers Light & Heat Company, Coraopolis, Pennsylvania.

Odenkirk, H. B .... May 16, 1916
Retired, East Liberty Street, Wooster, Wayne County, Ohio.

O'Donnell, C. W .... May 16, 1911
Engineer, Equitable Meter Company, 422 First Avenue, Pittsburgh, Pennsylvania.

O'Donnell, John L .... May, 19, 1908
The Hanna Oil Company, Tulsa, Oklahoma.

O'Hara, Charles .... May 16, 1916
Field Clerk, The Manufacturers Light & Heat Company, Waynesburg, Pennsylvania.

O'Hara, Lawrence .... May 16, 1916
Field Foreman, The Manufacturers Light & Heat Company, Waynesburg, Pennsylvania.

O'Leary, Dennis .... May 20, 1913
Chief Engineer, Pennsylvania Gas Company, Lodlow, Pennsylvania.

Oliphant, Bert C .... May 21, 1912
President, Iroquois Natural Gas Company, 37 Church Street, Buffalo, New York.

Olmstead, J. F .... May 16, 1916
Agent, Logan Natural Gas & Fuel Company, Mansfield, Ohio.

Oliver, C. E .... May 20, 1913
Chief, Pressure Department, United Natural Gas Company, 206 Seneca Street, Oil City, Pennsylvania.

O'Neill, Charles .... May 21, 1907
Superintendent of Distribution, Webb City and Carterville Gas Company, Carthage Gas Company, Webb City, Missouri.

Ossenbeck, Fred J .... May 21, 1912
Secretary-Treasurer, The Ardizone Company, 507-508 Bliss Building, Tulsa, Oklahoma.

Ostermaier, John .... May 16, 1916
District Foreman, Equitable Gas Company, 23rd Street and Liberty Avenue, Pittsburgh, Pennsylvania.

Ostrye, Peter L .... May 16, 1916
Superintendent, Meter Department, East Ohio Gas Company, Hendon Avenue, West Park, Cleveland, Ohio.

Owens, Charles .... May 16, 1916
District Superintendent, American Natural Gas Company, Vandergrift, Pennsylvania.

Palm, C. J .... May 16, 1916
Superintendent, Lease Department, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Palmer, J. F .... May 16, 1916
Superintendent, Arkansas Natural Gas Company, Shreveport, Louisiana.

Palmer, W. M .... May 18, 1915
District Superintendent, Caddo Division, Southwestern Gas & Electric Company, 116 Texas Street, Shreveport, Louisiana.

Paris, A. J., Jr .... May 16, 1916
Gas Engineer, Natural Gas Products Company, Philadelphia Street, Bradford, Pennsylvania.

Parker, John F.......................................June 12, 1906
Western Sales Manager, Eclipse Gas Stove Company, South Main Street, Rockford, Illinois.

Parks, R. N.......................................May 18, 1915
Engineer in charge of the Meter Department, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Patterson, A. B.......................................May 19, 1914
Manager, New York Belting Packing Company, 420 First Avenue, Pittsburgh, Pennsylvania.

Patterson, T. H.......................................May 16, 1916
Field Superintendent, American Natural Gas Company, Freeport, Pennsylvania.

Patterson, William M.......................................May 18, 1909
In charge of Pipe Department, Frick Lindsay Company, 109 Wood Street, Pittsburgh, Pennsylvania.

Pattinson, R. L.......................................May 19, 1914
President, Medina Natural Gas Company, 29 Fifth Street, Chatham, Ontario, Canada.

Payne, A. I.......................................May 21, 1912
Consulting Gas Engineer, P. O. Box 571, Calgary, Alberta, Canada.

Payne, Christy.......................................May 18, 1915
Attorney and Secretary, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Payne, Frank H.......................................May 20, 1913
Manager, Metric Metal Works, P. O. Box 710, Erie, Pennsylvania.

Pearson, H. B.......................................May 19, 1914
General Superintendent, The Canadian Western Natural Gas, Light, Heat & Power Company, Limited, 215 Sixth Avenue, West, Calgary, Alberta, Canada.

Peddicord, T. B.......................................May 18, 1915
Agent, Pittsburgh & West Virginia Gas Company, Union National Bank Building, Clarksburg, West Virginia.

Penhale, J. W.......................................May 18, 1915
Superintendent, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Perdue, J. L.......................................May 16, 1916
Superintendent, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Perry, J. S.......................................May 16, 1916
Gas Producer, Brighton Hotel, Washington, D. C.

Pew, James G.......................................May 16, 1916
Superintendent, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Pew, John G.......................................May 20, 1913
Vice-President, Hope Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Pfeifer, A. S.......................................May 16, 1916
Field Superintendent, American Natural Gas Company, Evans City, Pennsylvania.

Phillips, C. C.......................................May 18, 1915
Chief Clerk, Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Phillips, Henry T.......................................May 16, 1916
Gas Magazine, Service Publishing Company, 179 East Long Street, Columbus, Ohio.

Phillips, John..May 16, 1916
Engineer, The Manufacturers Light & Heat Company, Porter's Falls, West Virginia.

Pick, Earle..May 16, 1916
Agent, The Peoples Natural Gas Company, Greensburg, Pennsylvania.

Pinckard, T. Pates..May 18, 1915
Secretary, Windsor Gas Company, Limited, 56 Ouellette Avenue, Windsor, Ontario, Canada.

Pinkston, Tom..May 19, 1914
Purchasing Agent, Lone Star Gas Company, P. O. Box 1022, Ft. Worth, Texas.

Plagenz, George W..May 18, 1915
Secretary to Secretary-Treasurer, The East Ohio Gas Company, 1447 East Sixth Street, Cleveland, Ohio.

Plantinga, P..May 20, 1913
President, The Gas Machinery Company, 1900 Euclid Avenue, Cleveland, Ohio.

Poe, D. M..May 18, 1915
Foreman, Columbia Gas & Electric Company, Branchland, West Virginia.

Poole, C. J..May 16, 1916
Agent, Fayette County Gas Company, 302 South Pittsburgh Street, Connellsville, Pennsylvania.

Pope, Worden..May 16, 1916
Engineer, Henry L. Doherty & Company, 60 Wall Street, New York, New York.

Porterfield, Harry..May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Wilkinsburg, Pennsylvania.

Porterfield, R. M..May 16, 1916
Inspector, Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Posgate, James S..May 17, 1910
Mechanical Engineer, Cia Mexicana de Petroles "El Agnila" S. A., Tampico, Mexico.

Potter, W. F..May 19, 1914
Vice-President and Editor, The Oil and Gas Journal, 114 West Second Street, Tulsa, Oklahoma.

Powers, Nicholas..May 16, 1916
Oil and Gas Well Contractor, Powers Brothers, Fairmont, West Virginia.

Pratt, C. E..May 16, 1916
Foreman, Meter Shops, Equitable Gas Company, 6306 Penn Avenue, Pittsburgh, Pennsylvania.

Pratt, Edward G..May 21, 1912
Consulting and Managing Gas Engineer, 627-628 Peoples Gas Building, Chicago, Illinois.

Preston, S. C..May 16, 1916
Chief Engineer, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Price, P. I..May 17, 1910
Managing Director, The United Gas Companies, Ltd., 45 King Street, St. Catherines, Ontario, Canada.

Price, W. W..May 18, 1909
President, Dayton Pipe Coupling Company, Edmun Street, Dayton, Ohio.

Prior, Charles J..May 20, 1913
Assistant to Manager, Metric Metal Works, 339 East 7th Street, Erie, Pennsylvania.

Pryor, F. B..May 16, 1911
Secretary, Fairmont Gas and Light Company, Jefferson Street, Fairmont, West Virginia.

Purdy, J. S. L..May 19, 1914
General Manager, The Pavilion Natural Gas Company, 68 Main Street, LeRoy, New York.

Pyzel, Dr. E. D..May 17, 1910
Gas Engineer, Heerengracht 141-145, Amsterdam, Holland.

Quay, H. A..May 18, 1915
General Foreman, Manufacturers Light & Heat Company, Columbia Bank Building, Pittsburgh, Pennsylvania.

Quinlin, Ambrose J..May 20, 1913
General Foreman, The East Ohio Gas Company, 358 Park Street, Akron, Ohio.

Quinlan, P. J..May 16, 1916
Shop Foreman, The River Gas Company, 228 Third Street, Marietta, Ohio.

Rae, A. B..May 20, 1913
Foreman, The East Ohio Gas Company, 4706 Lorain Avenue, Cleveland, Ohio.

Ralph, Charles A..May 18, 1915
Ralph Brothers, Aspinwall, Pennsylvania.

Ralston, William S..May 18, 1909
Vice-President, Chaplin Fulton Manufacturing Company, 34 Penn Avenue, Pittsburgh, Pennsylvania.

Ramage, J. R..May 16, 1916
Louisville Gas & Electric Company, 311 West Chestnut Street, Louisville, Kentucky.

Randolph, Ernest..May 19, 1914
Oil and Gas Operator, 510 Goff Building, Clarksburg, West Virginia.

Randolph, M. D..May 16, 1916
Foreman, Arkansas Natural Gas Company, Pine Bluff, Arkansas.

Rankin, Harvey..May 16, 1916
Head Leaseman, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Ratcliffe, George L..May 16, 1916
Agent, The Peoples Natural Gas Company, Woodlawn, Pennsylvania.

Ratcliffe, George W..May 21, 1912
Treasurer, Manufacturers Light & Heat Company, 248 Fourth Avenue, Pittsburgh, Pennsylvania.

Reckard, G. H..May 16, 1916
Purchasing Agent, The Miller Supply Company, Huntington, West Virginia.

Redic, Samuel..May 16, 1911
Representative, Spang & Company, Butler, Pennsylvania.

Reed, Charles C..May 16, 1916
Construction Engineer, Hope Natural Gas Company, Despard Street, Clarksburg, West Virginia.

Reed, F. L..May 16, 1916
Agent, The River Gas Company, 701 Second Street, Marietta, Ohio.

Reed, J. A..May 16, 1911
Assistant General Superintendent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Reed, James H..May 16, 1916
President, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Reed, J. H., Jr..May 16, 1911
General Purchasing Agent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Reed, N. W..May 16, 1916
Agent, Clarion Gas Company, 513 Main Street, Clarion, Pennsylvania.

Reeger, George B..May 16, 1916
Field Superintendent, American Natural Gas Company, R. F. D. No. 1, Greensburg, Pennsylvania.

Reel, G. W..May 16, 1916
Contractor, Hope Gas Company, Kenyon Avenue, West View, Pittsburgh, Pennsylvania.

Reeser, E. B..May 20, 1913
General Manager, Potter Gas Company, Farmers Bank Building, Pittsburgh, Pennsylvania.

Reeser, F. B..May 18, 1915
Agent, The Ohio Fuel Supply Company, 106 South Main Street, Miamisburg, Ohio.

Reeser, Harry C..May 17, 1910
Assistant to the President, Ohio Fuel Supply Company, 2017 Farmers Bank Building, Pittsburgh, Pennsylvania.

Reeser, J. W..May 19, 1914
General Superintendent, United Fuel Gas Company, 517 Sixth Street, Huntington, West Virginia.

Reichel, C. D..May 20, 1913
Information and Complaint Clerk, The Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Reichert, Win..May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Wilkinsburg, Pennsylvania.

Reilly, W. J..May 16, 1916
Regulator Man and Linewalker, The Peoples Natural Gas Company, 1919 Forbes Street, Pittsburgh, Pennsylvania.

Renick, J. D..May 16, 1916
Inspector, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Reul, William H..May 20, 1913
Superintendent Fitting Department, The Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Reynolds, H. G..May 17, 1910
Sole Owner, Reynolds Gas Regulator Company, 1019 Delaware Street, Anderson, Indiana.

Rhea, W. W..May 19, 1914
General Superintendent, Indian Territory Illuminating Oil and Gas Company, 904 Delaware Avenue, Bartlesville, Oklahoma.

Rich, A. R..May 18, 1915
Superintendent, Columbus Producing Company, Miami, West Virginia.

Rich, Edward B..May 16, 1911
President, University Oil Company, P. O. Box 628, Parkersburg, West Virginia.

Rich, Fred S..May 18, 1915
President, Crude Oil Company, Oil City, Pennsylvania.

Richards, W. H..May 16, 1916
Treasurer, Potter Gas Company, Port Allegheny, Pennsylvania.

Richter, William F..May 16, 1916
Foreman, Fayette County Gas Company, Painter Street, South McConnellsville, Pennsylvania.

Riddle, George B..May 18, 1915
Superintendent, The Natural Gas Company of West Virginia, 1226 Chaplin Street, Wheeling, West Virginia.

Ridgway, J. L..May 16, 1916
Field Foreman, The Peoples Natural Gas Company, Brave, Pennsylvania.

Riggs, D. B..May 18, 1915
Foreman, Ohio Fuel Supply Company, 736 Fountain Square, Zanesville, Ohio.

Riggs, Ross..May 19, 1914
Northeastern Oil & Gas Company, R. D. No. 1, Jefferson, Ohio.

Riley, George N..May 16, 1911
Engineer, National Tube Company, Frick Building, Pittsburgh, Pennsylvania.

Ripley, L. O..May 21, 1912
Vice-President and General Manager, Kansas Gas & Electric Company, 237-239 South Main Street, Wichita, Kansas.

Roberts, C. C..May 16, 1916
Superintendent, Southern Ontario Gas Company, Talbat Street, St. Thomas, Ontario, Canada.

Roberts, W. T..May 16, 1916
Inspector, Arkansas Natural Gas Company, Little Rock, Arkansas.

Robertson, D..May 16, 1916
Treasurer, Pittsburgh Oil & Gas Company, 1005 Farmers Bank Building, Pittsburgh, Pennsylvania.

Robertson, D. S..May 16, 1916
Superintendent, Jantha Light & Fuel Company, Greenville, Ohio.

Robertson, John R..May 21, 1912
Owner and Producer, Jacksonville, Illinois.

Robinson, Edwin..May 18, 1915
Secretary-Treasurer, West Virginia Natural Gas Association, Jacobs Building, Fairmont, West Virginia.

Robinson, E., Jr..May 20, 1913
Superintendent Supplies, Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Robinson, George..May 17, 1910
Oil Operator, Wayne Oil & Gas Company, Independence, Kansas.

Robinson, L. E..May 21, 1912
General Manager, The Robinson Packer and Machine Company, 141 Spruce Street, Coffeyville, Kansas.

Rockwell, C. O..May 20, 1913
Superintendent, The Ohio Fuel Supply Company, 207 East Burgess Street, Mt. Vernon, Ohio.

Rodgers, Edward H..May 19, 1908
President, Standard Meter Company, 3112 North 17th Street, Philadelphia, Pennsylvania.

Rogers, Homer R..May 18, 1909
Superintendent, Newark Natural Gas & Fuel Company, 518 Mt. Vernon Road, Newark, Ohio.

Rogers, W. J..........May 16, 1916
General Solicitor, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Rooney, E. S..........May 18, 1909
District Sales Agent, The Youngstown Sheet and Tube Company, 1626 Oliver Building, Pittsburgh, Pennsylvania.

Romano, M..........May 16, 1916
Employee, M. L. & H. Company, and Independent, 119 Shetland Avenue, East Pittsburgh, Pennsylvania.

Ross, S. C..........May 16, 1916
Foreman, The Manufacturers Light & Heat Company, Bellevue, Pennsylvania.

Rose, W. J..........May 20, 1913
Manager, Alliance Gas & Power Company, Alliance, Ohio.

Rothert, E. R..........May 18, 1915
Solicitor, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Rowland, Willard J..........May 16, 1911
President, Creek County Gas Company, 1918 First National Bank Building, Pittsburgh, Pennsylvania.

Rumbaugh, G. N..........May 16, 1916
Assistant to General Superintendent, C. B. Shaffer Interests, Drumright, Oklahoma.

Rupp, C. H..........May 18, 1915
Assistant Treasurer, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Russell, G. W..........May 18, 1915
Superintendent, Ardmore City Gas Company, 220 West Main Street, Ardmore, Oklahoma.

Rutz, A. O..........May 16, 1916
General Manager, Milwaukee Gas Specialty Company, 133 Second Street, Milwaukee, Wisconsin.

Ryan, W. G..........May 16, 1916
Producer, Chatham, Ontario, Canada.

Sackett, Edward..........May 16, 1916
Meter Engineer, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Sample, D..........May 16, 1916
Field Superintendent, American Natural Gas Company, Allison Park, Pennsylvania.

Sands, Louis C..........May 18, 1909
Vice President, The Oil Well Supply Company, 215 Water Street, Pittsburgh, Pennsylvania.

Sarchet, A. C..........May 16, 1911
Agent, The Ohio Fuel Supply Company, 142 North Ninth Street, Cambridge, Ohio.

Saul, Milt..........May 18, 1915
Editor, Gas Record, Monadnock Block, Chicago, Illinois.

De Saulles, C. A. H..........May 19, 1908
American Smelting and Refining Company, 165 Broadway, New York, New York.

Schaffer, Hose..........May 16, 1916
Foreman, The Manufacturers Light & Heat Company, Washington, Pennsylvania.

Schalek, John H..........May 16, 1916
Meter Tester and Repairman, Manufacturers Light & Heat Company, 411 Clarence Street, Pittsburgh, Pennsylvania.

Schall, Henry D.......................................May 17, 1910
Assistant to Vice-President, Detroit Stove Works, 1320-60 Jefferson Avenue, Detroit, Michigan.

Schatzel, G. P.......................................May 16, 1916
Agent, Logan Natural Gas & Fuel Company, 114 West Front Street, Findlay, Ohio.

Schauer, Frank F.......................................May 21, 1912
Assistant Engineer, Kansas City Gas Company, 910 Grand Avenue, Kansas City, Missouri.

Schell, George W.......................................May 17, 1910
West Virginia Central Gas Company, Weston, Lewis County, West Virginia.

Schell, W. F.......................................May 18, 1915
Mechanical Engineer, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Schiffler, William J.......................................May 16, 1916
Warehouseman, Hope Natural Gas Company, 108 School Street, Clarksburg, West Virginia.

Schlaudecker, E. M.......................................May 20, 1913
Manager, Pennsylvania Gas Company, Jameston, New York.

Schlosser, A. J.......................................May 16, 1916
Chief Engineer, Potter Gas Company, Shinglehouse, Pennsylvania.

Schmidt, Elmer F.......................................May 18, 1915
Assistant Engineer, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Schneider, M. C.......................................May 19, 1914
Assistant to General Superintendent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Schneidewind, Alberto.......................................May 18, 1915
President de la Comision Administradora, Explotacion del Petroleo de Comodoro Ruvadavia, 278 Balcarce, Buenos Aires, Argentine Republic.

Schornstein, Fred F.......................................May 18, 1915
Salesman, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Schwarm, C. A.......................................May 21, 1907
704 Union Trust Building, Detroit, Michigan.

Scott, G. C.......................................May 18, 1909
Secretary-Treasurer, The Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Scott, John Milton.......................................May 18, 1909
Secretary and Treasurer, Kansas City Gas Company, 910 Grand Avenue, Kansas City, Missouri.

Scott, W. H.......................................May 16, 1911
Teller, The Northwestern Ohio Natural Gas Company, 210-212 Huron Street, Toledo, Ohio.

Searle, Robert Meredith.......................................May 21, 1912
Vice-President, Rochester Railway & Light Company, 34 Clinton Avenue, North, Rochester, New York.

Seachrist, Charles E.......................................May 16, 1916
Foreman, The Manufacturers Light & Heat Company, Millbridge and Manton Street, Pittsburgh, Pennsylvania.

Secrist, M. F.......................................May 16, 1916
Foreman, Arkansas Natural Gas Company, Hope, Arkansas.

Seice, Jos..May 16, 1916
Field Superintendent, American Natural Gas Company, R. F. D. No. 2, Kittanning, Pennsylvania.

Sedberry, W. H....................................May 16, 1911
Manager, Marshall Gas Company and Louisiana-Texas Natural Gas Company, Rusk and Bolivar Streets, Marshall, Texas.

Seeger, Robert....................................May 21, 1907
District Manager, Welsbach Street Lighting Company of America, 704 Laclede Gas Building, St. Louis, Missouri.

Seibel, John.......................................May 16, 1911
Night Watchman, Logan Natural Gas & Fuel Company, 612 North Cory Street, Findlay, Ohio.

Seyffert, L. A.....................................May 20, 1913
Assistant Treasurer, Union Fuel Gas Company, 2008 Farmers Bank Building, Pittsburgh, Pennsylvania.

Shade, R. S..May 19, 1914
Assistant Superintendent Main Lines and Distribution, Kansas Natural Gas Company, 201 Second Street, Independence, Kansas.

Shaffer, Charles F.................................May 16, 1916
Field Foreman, The Manufacturers Light & Heat Company, Coraopolis, Pennsylvania.

Shaffner, D. C.....................................May 18, 1915
Superintendent Distribution, Union Light, Heat & Power Company, Court and Park Place, Covington, Kentucky.

Shannon, Ogden K...................................May 17, 1910
Manager, The Forth Worth Gas Company, Eleventh and Throckmorton Street, Fort Worth, Texas.

Sharp, J. W..May 16, 1916
President, Greensboro Gas Company, 248 Fourth Avenue, Pittsburgh, Pennsylvania.

Shaw, S. T...May 16, 1916
Agent, The Peoples Natural Gas Company, Latrobe, Pennsylvania.

Shear, Robert......................................May 16, 1911
Secretary, Home Gas Company, Mt. Morris, Pennsylvania.

Sheets, William L..................................May 16, 1916
Clerk, Pittsburgh and West Virginia Gas Company, East Center Street, Weston, West Virginia.

Sheppard, John C...................................May 16, 1911
Superintendent, Chaplin-Fulton Manufacturing Company, 28-34 Penn Avenue, Pittsburgh, Pennsylvania.

Shepard, W. H......................................May 19, 1908
Treasurer and Manager, Coffeyville Gas & Fuel Company, 112 West Eighth Street, Coffeyville, Kansas.

Sherlock Amy (Miss)................................May 20, 1913
Assistant Treasurer, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Sherwood, M. G.....................................May 16, 1916
Field Foreman, The Manufacturers Light & Heat Company, Atwood, West Virginia.

Shiebler, Marvin...................................May 17, 1910
Consulting Gas Engineer, 50 Church Street, New York, New York.

Shinnick, George S.................................May 16, 1916
Commercial Manager, Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Shoop, Alfred..........May 16, 1916
Field Superintendent, American Natural Gas Company, Rural Valley, Pennsylvania.

Shoub, John F..........May 20, 1913
Secretary, The Delaware Gas Company, 68 North Sandusky Street, Delaware, Ohio.

Shulters, C. W..........May 20, 1913
Cashier, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Shulters, Hoyt V..........May 21, 1912
Secretary and Treasurer, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Shuster, Z. H..........May 16, 1916
District Superintendent, American Natural Gas Company, Kittanning, Pennsylvania.

Sibley, E. D..........May 16, 1916
Engineer, West Virginia T. & E. Company, Morgantown, West Virginia.

Siess, Edmund..........May 18, 1915
Secretary to Assistant General Manager, The East Ohio Gas Company, 1447 East Sixth Street, Cleveland, Ohio.

Silliman, L. R..........May 16, 1916
District Foreman, Equitable Gas Company, Tarentum, Pennsylvania.

Silva, Albert..........May 18, 1915
Secretary-Treasurer, The Union Light, Heat & Power Company, Covington, Kentucky.

Simmons, L. M..........May 20, 1913
Agent, The United Natural Gas Company, Du Bois, Pennsylvania.

Simmons, W. P..........May 16, 1916
Agent, The Manufacturers Light & Heat Company, Washington, Pennsylvania.

Simpson, J. M..........May 18, 1915
Assistant Purchasing Agent, The Ohio Fuel Supply Company, 2017 Farmers Bank Building, Pittsburgh, Pennsylvania.

Sinclair, E. W..........May 21, 1907
Secretary-Treasurer, The Wellington Gas Company, Independence, Kansas.

Singleton, Bert..........May 16, 1916
Foreman, Hope Natural Gas Company, 310 Dancer Street, Clarksburg, West Virginia.

Sipe, George B..........May 19, 1908
Manager, Louisiana Gas Company, 1719 Backus Street, Shreveport, Louisiana.

Sipe, William Everett..........May 16, 1911
Manager, Atlanta Gas Company, Atlanta, Texas.

Siverling, J. L..........May 16, 1916
Field Foreman, The Peoples Natural Gas Company, Elderton, Pennsylvania.

Sladen, H. S..........May 16, 1911
Wichita Manager, Kansas Gas & Electric Company, 237 South Main Street, Wichita, Kansas.

Sloan, F. M..........May 16, 1916
Operator, Murraysville, Pennsylvania.

Sloan, J. A...May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Portage, Pennsylvania.

Sloane, P. C...May 16, 1916
Agent, United Fuel Gas Company, Box 813, Charleston, West Virginia.

Smies, George H...May 20, 1913
Chief Clerk, The Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Smith, A. C...May 16, 1916
Operator, 507 Virginia Street, Charleston, West Virginia.

Smith, E. A...May 16, 1916
Auditor, American Natural Gas Company, 1511 Park Building, Pittsburgh, Pennsylvania.

Smith, Ernest B...May 18, 1909
Manager, The Coshocton Gas Company, Bachert Building, Coshocton, Ohio.

Smith, Edward...May 18, 1915
Chief Clerk, Well Accounting Department, The East Ohio Gas Company, 1513 Lincoln Avenue, Lakewood, Ohio.

Smith, H. L...May 16, 1916
Auditor, Carnegie Natural Gas Company, 922 Carnegie Building, Pittsburgh, Pennsylvania.

Smith, H. L...May 16, 1916
District Foreman, Equitable Gas Company, 147 East Fifth Avenue, Homestead, Pennsylvania.

Smith, Frank N...May 18, 1915
Pattern Superintendent, S. R. Dresser Manufacturing Company, 170 Davis Street, Bradford, Pennsylvania.

Smith, Malcolm C...May 16, 1916
Engineer, American Natural Gas Company, 1511 Park Building, Pittsburgh, Pennsylvania.

Smith, R. H...May 16, 1916
Vice-President, American Natural Gas Company, 1511 Park Building, Pittsburgh, Pennsylvania.

Smith, W. T...May 16, 1916
Foreman, Hope Natural Gas Company, 304 Clarksburg Street, Mannington, West Virginia.

Snoke, Alpheus...May 18, 1915
Field Superintendent, The Logan Natural Gas & Fuel Company, 900 Mechanic Street, Utica, Ohio.

Snyder, H. L...May 21, 1912
General Superintendent, Arkansas Natural Gas Company, 1108 State Bank Building, Little Rock, Arkansas.

Snyder, Robert M., Jr.................................March 20, 1906
President, New York Oil and Gas Company, Director, Kansas Natural Gas Company, Director, Caney Gas Company, 316 American Bank Building, Kansas City, Missouri.

Snyder, S. W...May 16, 1916
Foreman, United Natural Gas Company, 14 River Street, Sharon, Pennsylvania.

Soper, R. G...May 16, 1911
Secretary, The Dallas Gas Company, 2016 Jackson Street, Dallas, Texas.

South, W. H...May 18, 1915
Secretary-Treasurer, General Manager, Randall Gas Company, P. O. Box 554, Morgantown, West Virginia.

Spain, W. H..May 16, 1911
District Representative, Oil Well Supply Company, 215 Water Street, Pittsburgh, Pennsylvania.

Spicer, B. F..May 16, 1916
Agent, Logan Natural Gas & Fuel Company, Bucyrus, Ohio.

Sprague, H. H..May 17, 1910
President, Sprague Meter Company, 205 Water Street, Bridgeport, Connecticut.

Sprenkle, W. A..May 16, 1916
Secretary-Treasurer, Natural Gas Company of West Virginia, 323 Fourth Avenue, Pittsburgh, Pennsylvania.

Stainbrook, Chris..May 16, 1916
Assistant Foreman, The Manufacturers Light & Heat Company, Washington, Pennsylvania.

Staniek, A. E..May 16, 1916
Chief Clerk Contracting Department, Philadelphia Company, 435 Sixth Street, Pittsburgh, Pennsylvania.

Stearns, James W..May 20, 1913
Division Superintendent, Iroquois Natural Gas Company, 401 Iroquois Building, Buffalo, New York.

Steele, Oliver..May 16, 1916
Engineer, The Manufacturers Light & Heat Company, Majorsville, West Virginia.

Steenbergen, C. L..May 19, 1914
Manager, Paris Gas & Electric Company, Paris, Kentucky.

Stein, F. V..May 16, 1916
Foreman, United Natural Gas Company, 570 Arch Street, Meadville, Pennsylvania.

Steinecker, Harry..May 16, 1916
Foreman, The Manufacturers Light & Heat Company, Rochester, Pennsylvania.

Steinwedell, W. E..May 20, 1913
Secretary, The Gas Machinery Company, 1900 Euclid Avenue, Cleveland, Ohio.

Sternburg, F. M..May 19, 1914
Field Foreman, Iroquois Natural Gas Company, Evans Street, Hamburg, New York.

Stephens, Thos. H..May 16, 1916
Agent, The Manufacturers Light & Heat Company, East Liverpool, Ohio.

Sterrett, Louis E..May 16, 1916
Manager, Smithport Gas Company, Smithport, Pennsylvania.

Stewart, S. B..May 17, 1910
General Contracting Agent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Stewart, William..May 16, 1916
General Foreman, Allegheny Heating Company, 603 Burd Street, North Side, Pittsburgh, Pennsylvania.

Stett, John C..May 16, 1916
Field Foreman, Carnegie Natural Gas Company, West Union, West Virginia.

Stokes, D. J., Jr..May 16, 1916
Field Superintendent, The Natural Gas Company of West Virginia, Harveys, Greene County, Pennsylvania.

Stone, Frederick W..May 21, 1907
Manager, Ashtabula Gas Company, 6 Progress Street, Ashtabula, Ohio.

Storey, Verne W....................................May 18, 1915
Vice President and Manager, Dixie Gas & Water Company, Box 121, Oil City, Louisiana.

Stotler, R. M....................................May 19, 1908
District Manager, Pittsburgh Meter Company, 605 Victor Building, Kansas City, Missouri.

Stout, Wilber....................................May 16, 1916
Assistant Geologist, Geological Survey of Ohio, 40 East Lane Avenue, Columbus, Ohio.

Streiber, Theo....................................May 20, 1913
Superintendent of Contracts, Sun Vapor & Gas Street Light Company, 1000 South Market Street, Canton, Ohio.

Strickler, James P....................................May 21, 1907
Superintendent, Distribution, Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Strickler, W. W....................................May 17, 1910
W. W. Strickler & Brothers, Columbus, Ohio.

Stringer, Harrison....................................May 18, 1915
Superintendent, Dominion Natural Gas Company, Simcoe, Ontario, Canada.

Strong, Murray....................................May 16, 1916
Foreman, Arkansas Natural Gas Company, Arkadelphia, Arkansas.

Stuart, George J....................................May 16, 1911
Chief Engineer, Pittsburgh Valve, Foundry and Construction Company, 26th Street and A. V. R. R., Pittsburgh, Pennsylvania.

Stuchell, F. L.....................................June 12, 1906
Fairmont Gas Company, Fairmont, West Virginia.

Stull, R. O....................................May 19, 1914
Purchasing Agent, Quapaw Gas Company, 515 Chickesaw Avenue, Bartlesville, Oklahoma.

Sullivan, J. H....................................May 20, 1913
Superintendent, Street Department, The East Ohio Gas Company, East 62nd, North of St. Clair, Cleveland, Ohio.

Sullivan, P. D....................................May 16, 1916
Foreman, Iroquois Natural Gas Company, 37 Church Street, Buffalo, New York.

Sullivan, T. O....................................May 16, 1911
General Manager, Manufacturers Light & Heat Company, 314 Columbia Bank Building, Pittsburgh, Pennsylvania.

Sutton, A. I....................................May 16, 1916
Foreman, Hope Natural Gas Company, R. F. D., St. Marys, West Virginia.

Swan, George J....................................May 18, 1909
Superintendent, Consumers Light, Heat & Power Company, 214 East First Street, Topeka, Kansas.

Swartz, J. K....................................May 16, 1916
Foreman, Hope Natural Gas Company, Salem, West Virginia.

Sweetman, W. D....................................May 16, 1911
Superintendent, Peoples Gas Light and Coke Company, 1241 West Dinisian Street, Chicago, Illinois.

Sykes, J. D....................................May 16, 1911
Superintendent, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Tanner, J. Roy..........May 16, 1911
General Manager, Pittsburgh Valve, Foundry & Construction Company, P. O. Box 1016, Pittsburgh, Pennsylvania.

Taylor, E. R..........May 18, 1915
Secretary and Treasurer, Fayette Light & Fuel Company, Fayette, Alabama.

Taylor, H. Prentiss..........May 16, 1911
President, Tri-County Natural Gas Company, 223 Fourth Avenue, Pittsburgh, Pennsylvania.

Taylor, J. W..........May 16, 1916
Foreman, Reserve Gas Company, 226 Bennett Street, Weston, West Virginia.

Taylor, Norwood J..........May 16, 1916
Field Clerk, Manufacturers Light & Heat company, Atwood, West Virginia.

Teague, O. C..........May 21, 1912
Vice-President, The Utica Gas, Oil & Mining Company, Utica, Ohio.

Terry, L. B..........May 16, 1911
Agent, The East Ohio Gas Company, 19-21 North High Street, Akron, Ohio.

Thatcher, J. H..........May 21, 1912
Manager, Mansfield Gas Company, Jefferson Street, Mansfield, Louisiana.

Thiel, Martin A..........May 18, 1915
Chief Engineer, Engine Department, The C. & G. Cooper Company, 118 East Lamartine Street, Mt. Vernon, Ohio.

Thomas, Edgar..........May 20, 1913
Gas Engineer, Hope Engineering Company, 826 Farmers Bank Building, Pittsburgh, Pennsylvania.

Thomas, Fred H..........May 16, 1916
Sales Manager, The C. & G. Cooper Company, Mt. Vernon, Ohio.

Thomas, Howard V..........May 16, 1911
Vice-President, West Virginia and Maryland Gas Company, 312 Fidelity Building, Buffalo, New York.

Thompson, Paul..........May 17, 1910
Fifth Vice-President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Thompson, William H..........May 16, 1911
Attorney, The Ohio Fuel Supply Company, 930 Williamson Building, Cleveland, Ohio.

Thomson, L. S..........May 18, 1915
Salesman, La Belle Iron Works, Steubenville, Ohio.

Tibbens, W. P..........May 20, 1913
Shop Foreman, The East Ohio Gas Company, 10611 Garfield Avenue, Cleveland, Ohio.

Tilloston, F. H..........May 20, 1913
City Foreman, The Pennsylvania Gas Company, 116 Broadhead Avenue, Jamestown, New York.

Tims, H. S..........May 18, 1915
Treasurer, The Canadian Western Natural Gas, Light, Heat & Power Company, Limited, 215 Sixth Avenue, West, Calgary, Alberta, Canada.

Tipper, Harry..........May 16, 1911
Manager Advertising Department, The Texas Company, 17 Battery Place, New York, New York.

Tippett, W. H........May 19, 1908
Secretary-Treasurer, Creek County Gas Company, Box 126, Cushing, Oklahoma.

Titzel, J. C........May 16, 1916
General Manager, Glenshaw Natural Gas Company, Glenshaw, Pennsylvania .

Tomb, Frank B........May 18, 1915
Superintendent Land Department, Southern Ontario Gas Company, Limited, 301 Central Avenue, London, Ontario, Canada.

Tomer, Adam........May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, 1919 Forbes Street, Pittsburgh, Pennsylvania.

Tonkin, John B........May 21, 1912
Treasurer, Hope Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Tonkin, Wade H........May 16, 1916
Agent, Hope Natural Gas Company, 250 West Tenth Street, Parkersburg, West Virginia.

Torrance, C. E........May 16, 1916
Agent, The Peoples Natural Gas Company, Altoona, Pennsylvania.

Torrance, J. M........May 16, 1916
Agent, The Peoples Natural Gas Company, Blairsville, Pennsylvania.

Towl, Forrest M........May 21, 1912
President, Southern Pipe Line Company, 26 Broadway, New York, New York.

Tracy, F. B........May 16, 1916
Manager Muncie Division, Central Indiana Gas Company, 301 East Main Street, Muncie, Indiana.

Tracey, F. D........May 16, 1911
Purchasing Agent, Eastern Oil Company, 312 Fidelity Building, Buffalo, New York.

Treat, Ellis M........May 16, 1911
President, Summerfield Gas Company, 2417 Farmers Bank Building, Pittsburgh, Pennsylvania.

Trees, J. C........May 16, 1911
President, Arkansas Natural Gas Company, Benedum-Trees Building, Pittsburgh, Pennsylvania.

Treleaven, L. G........May 21, 1907
Secretary and Manager, Consumers Light, Heat & Power Company, 824 Kansas Avenue, Topeka, Kansas.

Troutman, P. A........May 16, 1916
District Superintendent, Carnegie Natural Gas Company, Waynesburg, Pennsylvania.

Tucker, G. C........May 16, 1916
Foreman, The East Ohio Gas Company, 1101 Second, Massillon, Ohio.

Turner, Lyle........May 20, 1913
Credits and Collections, The East Ohio Gas Company, East Ohio Gas Building, Cleveland, Ohio.

Underwood, R. L........May 16, 1916
Manager and Assistant Secretary and Treasurer, Herring Oil & Gas Company, North Side Ellis, Groesbeck, Texas.

Vallely, George J..........May 16, 1916
Agent, Manufacturers Light & Heat Company, McDonald, Pennsylvania.

Van Blarcom, Howell..........May 18, 1909
Sales Manager, Pittsburgh District, The Westinghouse Machine Company, 500 Westinghouse Building, Pittsburgh, Pennsylvania.

Vance, George B..........May 16, 1916
Superintendent, Drilling Department, Randall Gas Company, Mapletown, Pennsylvania.

Vance, J. C..........May 19, 1914
Manager, Interstate Public Service Company, Greenfield, Indiana.

Vandergrift, T. T..........May 16, 1916
Field Superintendent, Preston Oil Company, Lancaster, Ohio.

VanSickle, Walter S..........May 17, 1910
General Manager, Southwestern General Gas Company, 516 No. "A" Street, Fort Smith, Arkansas.

Vincil, Edwin S..........May 21, 1912
Purchasing Agent, Kansas Natural Gas Company, P. O. Drawer "E," Independence, Kansas.

Voelkle, L. P..........May 18, 1915
Bookkeeper, The East Ohio Gas Company, East Ohio Gas Building, Cleveland, Ohio.

Wadsworth, W. A..........May 18, 1915
Assistant Commercial Manager, Union Light, Heat & Power Company, Covington, Kentucky.

Wagner, E. E..........May 16, 1916
Advertising Manager, The East Ohio Gas Company, East Ohio Gas Building, Cleveland, Ohio.

Wagner, E. W..........May 16, 1916
Acting Special Agent, The East Ohio Gas Company, East Ohio Gas Building, Cleveland, Ohio.

Wagner, L..........May 16, 1916
Field Superintendent, American Natural Gas Company, Glenshaw, Pennsylvania.

Walker, W. O..........May 16, 1916
Secretary and Treasurer, Central Kentucky Natural Gas Company, Oil City, Pennsylvania.

Wall, W. A..........May 18, 1915
Auditor, Southwestern Gas & Electric Company, Caddo Division, Shreveport, Louisiana.

Wallace, H. A..........May 18, 1915
General Superintendent, United Fuel Gas Company, 919 Quarrier Street, Charleston, West Virginia.

Wallace, J. B..........May 18, 1915
Superintendent, Logan Natural Gas & Fuel Company, 134 College Avenue, Ashland, Ohio.

Walsh, D. C..........May 20, 1913
General Foreman, The East Ohio Gas Company, 400 Tuscarawas Avenue, Canton, Ohio.

Walsh, H. F..........May 16, 1916
Field Foreman, The Manufacturers Light & Heat Company, Hundred, West Virginia.

Walsh, John H..........May 20, 1913
Superintendent, Iroquois Natural Gas Company, Church and Franklin Streets, Buffalo, New York.

Walsh, Maurice W.................................February 27, 1906
Superintendent Distribution and Construction, The Louisville Gas and Electric Company, 311 West Chestnut Street, Louisville, Kentucky.

Walters, C. K...May 16, 1916
District Foreman, Equitable Gas Company, Chestnut and Lydia Streets, Carnegie, Pennsylvania.

Walton, J. D...May 18, 1915
General Inspector, 315 Trenton Avenue, Uhrichsville, Ohio.

Wanamaker, George B.................................May 20, 1913
General Manager, The Highland Development Company, Lock Box 56, Wooster, Ohio.

Ward, C. F...May 16, 1916
Foreman Construction Department, Ohio Fuel Supply Company, Homer, Ohio.

Ward, R. W...May 20, 1913
Foreman, United Natural Gas Company, Oil City, Pennsylvania.

Wardell, Charles W.................................May 20, 1913
Welsbach Company, Gloucester, New Jersey.

Waring, C. H...May 21, 1912
Superintendent, The Wyandotte County Gas Company, 600 Minnesota Avenue, Kansas City, Kansas.

Watterson, Gabriel ....May 16, 1916
Field Superintendent, American Natural Gas Company, R. F. D. No. 1, Creekside, Pennsylvania.

Watson, W. E...May 21, 1912
Assistant General Manager of Sales, The Youngstown Sheet and Tube Company, Youngstown, Ohio.

Watts, Albert ....May 21, 1912
Oil and Gas Producer, 1401 South Carson Street, Tulsa, Oklahoma.

Way, William B...May 18, 1909
District Manager, The Ludlow Valve Manufacturing Company, 2008 First National Bank Building, Pittsburgh, Pennsylvania.

Wearing, George E.................................May 16, 1916
Field Manager, Elk Natural Gas Company, Clarion, Pennsylvania.

Weaver, S. D...May 16, 1916
Agent, Manufacturers Gas Company, Bradford, Pennsylvania.

Webber, Daniel S.....................................May 20, 1913
Superintendent Lease Department, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Weir, James B...May 18, 1915
Secretary-Treasurer, Falling Rock Cannel Coal Company, National City Bank Building, Charleston, West Virginia.

Weisgerber, E. C.....................................May 17, 1910
Gas Engineer, 116 Seymour Avenue, Newark, New Jersey.

Welch, John S.....................................February 27, 1906
Chief Salesman, United Gas Improvement Company, (Philadelphia Works), 1035 Market Street, Philadelphia, Pennsylvania.

Welch, William M.................................February 27, 1906
Gas Engineer, United States Bureau of Mines, 506 Customhouse, San Francisco, California.

Welker, George E....................................May 20, 1913
Chief Engineer, Iroquois Natural Gas Company, 311 Iroquois Building, Buffalo, New York.

Wells, George C....................................May 16, 1916
Agent, Manufacturers Light & Heat Company, 1717 Main Street, Wellsburg, West Virginia.

Wells, L. D....................................May 18, 1915
District Superintendent, Caddo Division, Southwestern Gas & Electric Company, Vivian, Louisiana.

Wentzel, H. W....................................May 16, 1916
Assistant Storekeper, Equitable Gas Company, 23rd and Liberty Avenue, Pittsburgh, Pennsylvania.

Werner, E. M....................................May 20, 1913
New Business Department, The East Ohio Gas Company, 1447 East Sixth Street, Cleveland, Ohio.

West, Grant ....May 20, 1913
Chief Station Engineer, United Natural Gas Company, Sigel, Pennsylvania.

West, R. H....................................May 16, 1916
Agent, The Manufacturers Light & Heat Company, Steubenville, Ohio.

Westcott, Henry P....................................May 21, 1907
Engineer, Metric Metal Works, 1004 West 26th Street, Erie, Pennsylvania.

Weymouth, T. R....................................May 16, 1911
Chief Engineer, United Natural Gas Company, 308 Seneca Street, Oil City, Pennsylvania.

Wheeler, Edward M....................................May 21, 1912
Treasurer, West Virginia Central Gas Company, 312 Fidelity Building, Buffalo, New York.

Wheelhouse, Sidney H....................................May 18, 1915
Manager Gas Furnace Department, Columbia Heating & Ventilating Company, 425-435 West Town Street, Columbus, Ohio.

Whitcomb, E. C....................................May 19, 1914
Chief Engineer, Manufacturers Gas Company, Brookville, Pennsylvania.

Whitcomb, E. P....................................May 18, 1909
Vice President and General Manager, The Union Natural Gas Corporation, Union Bank Building, Pittsburgh, Pennsylvania.

White, David ....May 16, 1916
Foreman, Hope Natural Gas Company, Lumberport, West Virginia.

White, T. J....................................May 16, 1916
Field Foreman, Carnegie Natural Gas Company, Hundred, West Virginia.

Whitehead, L. K....................................June 12, 1906
Superintendent, Gas Department, Southwestern Gas & Electric Company, 116 East Broad Street, Texarkana, Arkansas-Texas.

Wickham, T. F....................................May 20, 1913
Secretary-Treasurer, The Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Wickett, Gordon D....................................May 18, 1915
Treasurer, Windsor Gas Company, Limited, 56 Ouellette Avenue, Windsor, Ontario, Canada.

Wikoff, J. B..May 16, 1911
Treasurer, The Ohio Fuel Supply Company, 2107 Farmers Bank Building, Pittsburgh, Pennsylvania.

Wilkes, R. L..May 16, 1916
Auditor, American Natural Gas Company, 1511 Park Building, Pittsburgh, Pennsylvania.

Wilkinson, A. L..May 18, 1915
Treasurer, National Gas, Electric Light & Power Company, 1714 Ford Building, Detroit, Michigan.

Williams, John B..May 16, 1911
Secretary-Treasurer, The Sarnia Gas & Electric Company, Limited, 217 North Front Street, Sarnia, Ontario, Canada.

Williams, John H..May 16, 1916
Superintendent, Hope Natural Gas Company, Despard Street, Clarksburg, West Virginia.

Williams, R. J..May 20, 1913
Chief Engineer, United Natural Gas Company, Kane, R. D. No. 2, Pennsylvania.

Williams, W. A..May 20, 1913
Petroleum Technologist, United States Bureau of Mines, Washington, District of Columbia.

Williamson, E. W..May 16, 1916
Superintendent, Hope Natural Gas Company, 1722 St. Marys Avenue, Parkersburg, West Virginia.

Willoughby, Horace..May 18, 1909
Scioto Valley Supply Company, Third and Long Streets, Columbus, Ohio.

Wilson, A. M..May 16, 1911
Room 330, Robinson Building, Tulsa, Oklahoma.

Wilson, Henry M..May 16, 1911
District Agent, Pittsburgh Valve, Foundry & Construction Company, 1888 East 84th Street, Cleveland, Ohio.

Wilson, J. C..May 21, 1912
Engineer, Cutler Hammer Manufacturing Company, Twelfth Street and Saint Paul Avenue, Milwaukee, Wisconsin.

Wilson, J. W..May 18, 1915
Manager, Knall Oil & Gas Company, Weston, West Virginia.

Wilson, T. B..May 16, 1916
Field Superintendent, American Natural Gas Company, R. F. D. No. 1, Wilkinsburg, Pennsylvania.

Wimer, F. W..May 16, 1916
Assistant Foreman, The Manufacturers Light & Heat Company, R. F. D. No. 42, Portersville, Pennsylvania.

Wingard, Guy H..May 16, 1916
Foreman, Manufacturers Gas Company, Marlin Building, Brookville, Pennsylvania.

Wise, Bud..May 16, 1916
Field Clerk, The Manufacturers Light & Heat Company, Cameron, West Virginia.

Wittmer, George, Jr..May 16, 1911
Assistant General Manager, American Natural Gas Company, 1511 Park Building, Pittsburgh, Pennsylvania.

Wittmer, George X..May 19, 1908
Assistant Secretary and Treasurer, American Natural Gas Company, 407 Park Building, Pittsburgh, Pennsylvania.

Wittmer, Henry ....May 18, 1909
Secretary, American Natural Gas Company, 407 Park Building, Pittsburgh, Pennsylvania.

Wittmer, Thomas ....May 17, 1910
Division Superintendent, American Natural Gas Company, 1013 Sheridan Avenue, Pittsburgh, Pennsylvania.

Wolfe, D. A..May 16, 1916
Agent, The Manufacturers Light & Heat Company, McKees Rocks, Pennsylvania.

Wolfe, W. W..May 19, 1914
Assistant Secretary, United Fuel Gas Company, 1590 Quarrier Street, Charleston, West Virginia.

Wonderly, W. V..May 16, 1916
Superintendent Compression Plants, Logan Natural Gas Company, 34 Ruggery Building, Columbus, Ohio.

Wood, W. L., Jr...May 17, 1910
General Manager, Southwestern Gas & Electric Company, 116 East Broad Street, Texarkana, Arkansas.

Woodworth, R. B...May 16, 1911
Engineer, Carnegie Steel Company, 427 Carnegie Building, Pittsburgh, Pennsylvania.

Wrenn, J. W...May 20, 1913
Assistant General Manager, Economic Gas Company, 314 West Third Street, Los Angeles, California.

Wyer, Samuel S..May 21, 1912
Consulting Engineer, Huntington Bank Building, Columbus, Ohio.

Yardley, George ....May 20, 1913
Secretary to the General Manager, United Natural Gas Company, 206 Seneca Street, Oil City, Pennsylvania.

Yorke, Patrick ....May 16, 1911
Manager, Yorke Derrick Company, 199 North Main Street, Washington, Pennsylvania.

Young, F. H...May 19, 1914
Auditor, Arkansas Natural Gas Company, 1108 State Bank Building, Little Rock, Arkansas.

Young, James M. H...............................February 27, 1906
Manager, City Gas Company, 215 Dundar Street, London, Ontario, Canada.

Young, John ....May 16, 1916
Field Superintendent, American Natural Gas Company, Apollo, Pennsylvania.

Young, W. H...May 16, 1916
Purchasing Agent, South Hills Oil & Gas Company, 223 Fourth Avenue, Pittsburgh, Pennsylvania.

Young, William T..May 20, 1913
Mechanical Engineer, United Natural Gas Company, 513 North Street, Oil City., Pennsylvania.

Zeigler, R. A...May 20, 1913
Auditor, Central Indiana Gas Company, 301-3 East Main Street, Muncie, Indiana.

Zeller, S. E..May 20, 1913
General Foreman, The East Ohio Gas Company, 322 Wooster Avenue, Canal Dover, Ohio.

Zimerman, C. W..May 16, 1916
Chief Clerk, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Zimmerman, George W..................................**May 16, 1916**
Field Superintendent, American Natural Gas Company, 1218 Victoria Avenue, New Kensington, Pennsylvania.

Zitzewitz, W. R..**May 19, 1908**
Secretary-Treasurer, National Machine Works, Sheffield and North Avenue, Chicago, Illinois.

SUMMARY OF CLASSES OF MEMBERSHIP.

Honorary Members............................	8
Active Members................................	1,173
Total................................	1,181

GEOGRAPHICAL DISTRIBUTION

Alabama.

Fayette	E. R. Taylor

Arkansas.

Arkadelphia	Murray Strong
Forth Worth	Walter S. VanSickle
Hope	M. F. Secrist
Little Rock	W. F. Booth
	E. J. Cole
	B. J. Gifford
	John Russell Munce
	W. T. Roberts
	H. L. Snyder
	F. H. Young
Malvern	A. J. Gifford
Pine Bluff	Charles Edwin Bair
	M. D. Randolph
Prescott	James Barry
Texarkana	W. L. Wood, Jr.

California.

Los Angeles	George W. Barnes
	Frank Cavenagh
	Walter B. Cline
	John D. Hackstaff
	A. B. Macbeth
	Nathan L. Morse
	J. W. Wrenn
San Francisco	W. R. Hamilton
	John Martin
	William M. Welch
	W. A. Williams
Santa Maria	L. F. Chandler
Taft	J. F. McMahon
	William Moeller, Jr.

Connecticut.

Bridgeport	W. P. Hutchinson
	H. H. Sprague
Waterbury	John Douglas Alden

District of Columbia.

Washington	R. S. McBride
	J. S. Perry

Illinois.

Chicago	William A. Baehr
	O. M. Carter
	Henry M. Dawes
	W. H. Graffis
	W. S. Grear
	B. J. Kellum
	John W. Lansley
	Joseph C. Markley
	Edward G. Pratt
	Milt Saul
	W. D. Sweetman
	W. R. Zitzewitz
Decatur	Fred B. Mueller
Jacksonville	John R. Robertson
Olney	Raleigh Clark
Palestine	R. A. Crawford
Quincy	George J. Fischer
Rockford	John F. Parker

Indiana.

Anderson	J. C. Groble
	H. G. Reynolds
Greenfield	J. C. Vance
Indianapolis	E. M. Hinshaw
	S. T. Murdock
Marion	D. S. Milne
Middletown	C. R. Heath
Muncie	A. T. Bartow
	E. L. Haymond
	Harry R. Maxon
	John H. Maxon
	F. B. Tracy
	R. A. Zeigler

Kansas.

Chanute	Hugh T. Jones
Coffeyville	L. E. Robinson
	W. H. Shepard
Fredonia	B. E. LaDow
	C. V. LaDow

Kansas — Concluded.

Garnett	Gail Carey
Independence	H. I. Cowham
	Con. Cumings
	Frederick Doyle
	C. A. Gibson
	Victor A. Hayes
	G. F. Mahan
	George Robinson
	R. S. Shade
	E. W. Sinclair
	Edwin S. Vincil
Iola	F. J. Horton
Kansas City	J. W. Dana
	Thomas E. C. Lloyd
	Wm. Hunter McKenzie
	C. H. Waring
Lawrence	E. H. S. Bailey
	Caryl Dodds
	Erasmus Haworth
Moundsville	F. M. Gilmore
Pittsburg	J. H. Carter
	W. T. Hinchey
Sedgwick	C. F. Mason
Topeka	George J. Swan
	L. G. Treleaven
Wichita	C. L. Bullock
	W. M. Davis
	Rex Hoover
	Walter S. Hoyte
	E. S. Miller
	L. O. Ripley
	H. S. Sladen

Kentucky.

Ashland	J. W. Anderson
Covington	D. C. Shaffer
	Albert Silva
	W. A. Wadsworth
Louisville	Donald McDonald
	J. R. Ramage
	Maurice W. Walsh
Maysville	Horace J. Cochran
Paris	C. L. Steenbergen

Louisiana.

Aurora	Carroll Miller
Lewis	W. H. Buckley
Mansfield	J. H. Thatcher
Mooringsport	G. S. Boyd
	George E. Jordan
Oil City	Verne W. Storey
Shreveport	J. B. Ardis
	M. B. Carmody
	Austin G. Curtis
	C. A. Dally, Jr.
	T. J. Heard
	G. R. Jordan
	William G. Leet
	S. A. McCune
	T. F. O'Brian
	J. F. Palmer
	W. M. Palmer
	George B. Sipe
	W. A. Wall
Vivian	W. A. Long
	L. D. Wells

Massachusetts.

Boston	Godfrey L. Cabot

Maryland.

Baltimore	Charles M. Cohn
Cumberland	J. C. Cunningham

Michigan.

Detroit	D. F. Burritt
	R. A. Fields
	W. S. Guitteau
	James T. Lynn
	Henry D. Schall
	C. A. Schwarm
	A. L. Wilkinson

Missouri.

Joplin	Charles D. Bell
	B. J. Crahan
Kansas City	E. L. Brundrett
	R. W. Goodnow
	Alfred Hurlburt

Missouri — Concluded.

Kansas City	T. B. Jarvis
	Hoyle Jones
	R. L. Kidner
	Eugene Metz, Jr.
	Frank F. Schauer
	J. M. Scott
	R. M. Snyder, Jr.
	R. M. Stottler
	M. M. Sweetman
St. Joseph	V. L. Elbert
	J. W. Mitchell
St. Louis	C. L. Holman
	W. K. Hughes
	Lee B. Mettler
	Robert Seegar
Webb City	Charles O'Neill

New Jersey.

Gloucester City	Alphonso Mason
	Charles W. Wardell
Newark	E. C. Weisgerber

New York.

Albany	Charles F. Leonard
Batavia	William B. Davis
	Charles E. Hill
Buffalo	L. S. Bigelow
	W. M. Cusack
	H. R. Davis
	H. A. Forman
	B. J. Grammel
	Homer R. Gray
	William Hastings
	B. L. Hawkins
	Frank M. Lowry
	Edward P. McCormack
	John McMahon
	W. Lorne Munro
	Henry S. Norris
	Bert C. Oliphant
	James W. Stearns
	P. D. Sullivans
	Howard V. Thomas
	F. D. Tracey

New York — Concluded.

Buffalo	John H. Walsh
	George W. Welker
	Edward M. Wheeler
Caledonia	A. G. Baker
Corning	George S. Goff
	W. M. Gurnsey
Gowanda	M. McIntyre
Hamburg	John Hastings
	F. M. Sternburg
Honeoye Falls	Franklin L. Kellogg
Hornell	J. B. Bradley
Jamestown	E. M. Schlaudecker
	F. H. Tilloston
LeRoy	J. S. L. Purdy
New York	H. C. Abell
	W. E. Barrett
	A. C. Bedford
	R. W. Brink
	Cameron Brown
	L. G. Coleman
	J. W. R. Crawford
	S. J. Dill
	Henry L. Doherty
	A. E. Forstall
	H. B. Goodrich
	R. G. Griswold
	Alexander C. Humphreys
	George H. Jones
	W. J. Judge
	H. K. Landis
	Alanson P. Lathrop
	Henry O. Loebell
	Emerson McMillin
	Alten S. Miller
	Worden Pope
	C. A. H. De Saulles
	Marvin Sheibler
	Harry Tipper
	Forrest M. Towl
Rochester	R. M. Searle
Wellsville	Harry Bradley

Ohio.

Akron	Merrill N. Davis
	Ambrose J. Quinlin
	L. B. Terry
Alliance	W. J. Rose
Ashland	W. H. Adams
	A. E. Boyd
	H. D. Hull
	J. B. Wallace
Ashtabula	F. W. Stone
Barberton	S. C. McKnight
Bellaire	J. A. Fletcher
	W. H. Lockwood
Berea	M. K. Clover
Bucyrus	B. F. Spicer
Cadiz	Carl D. Mead
Cambridge	A. C. Sarchet
Canal Dover	Steve E. Zellar
Canton	Thomas M. Lee
	John J. McMahon
	W. J. Morgan
	Thos. Streiber
	D. C. Walsh
Chillicothe	Walter A. Ashley
Cincinnati	I. H. Alkire
	C. J. Bauer
	W. Y. Cartwright
	C. D. Corbus
	John M. Cronin
	J. P. Delaney
	Frank Espach
	Albert F. Flockin
	W. W. Freeman
	F. R. Healey
	H. J. Hoover
	Judson Harmon
	Charles Krause
	J. H. Lakamp
	C. R. McKay
	William A. Miller
	B. F. Newhouse
	C. D. Reichel
	William Reul
	E. R. Rothert
	F. F. Schornstein

Ohio — Continued.

Cincinnati	Amy Sherlock (Miss)
	George H. Smies
	T. F. Wickham
Cleveland	M. F. Barrett
	C. L. Bryant
	Martin B. Daly
	C. W. Downing
	Karl Emmerling
	E. C. Fox
	R. W. Gallagher
	C. W. Gardner
	A. L. Gassett
	C. B. Gates
	E. E. Given
	J. F. Gray
	W. G. Hagan
	J. H. Hanks
	George S. Harris
	W. C. Higgins
	W. H. Holtz
	George H. Horsley
	F. R. Hutchinson
	P. C. Jacobs
	W. H. Knight
	W. R. Knowles
	James Martin
	W. L. Oakes
	T. M. O'Conner
	George W. Plagenz
	P. Plantinga
	A. B. Rae
	C. W. Shulters
	Hoyt V. Shulters
	Edmund Siess
	W. E. Steinwedell
	J. H. Sullivan
	W. H. Thompson
	W. P. Tibbens
	Lyle Turner
	L. P. Voelkle
	E. E. Wagner
	E. W. Wagner
	E. M. Werner
	Henry M. Wilson

Ohio — Continued.

Columbus	S. S. Allen, Jr.
	H. T. Ashton
	A. M. Ballard
	J. A. Bownocker
	P. M. Biddison
	William J. Broder
	W. Re. Brown
	R. B. Burr
	Clarence E. Carter
	E. F. Clagett
	M. A. Corbett
	Henry Coyle
	F. H. Crawford
	F. W. Crawford
	C. F. Critchfield
	J. F. Curry
	Beman Dawes
	Leslie B. Denning
	D. H. Foster
	D. Friedenberg
	John M. Garard
	O. C. Hagan
	H. H. Hall
	John I. Henderson
	G. E. Howard
	C. H. Jay
	T. J. Jones
	T. H. Kerr
	Oscar Krebs
	Kay C. Krick
	Alan Leamy
	P. W. Lupher
	M. E. Lytle
	B. A. Magrew
	J. W. McCord
	M. A. Newton
	Nelson A. Newton
	Charles L. Norton
	C. J. Palm
	C. C. Phillips
	Henry T. Phillips
	R. M. Porterfield
	J. D. Renick
	E. Robinson, Jr.

Ohio — Continued.

Columbus	W. J. Rogers
	Elmer F. Schmidt
	G. C. Scott
	George S. Shinnick
	Wilber Stout
	James P. Strickler
	W. W. Strickler
	J. D. Sykes
	Daniel S. Webber
	Sidney H. Wheelhouse
	Horace Willoughby
	W. V. Wonderly
	Samuel S. Wyer
Dennison	E. B. Smith
Coshocton	Phil. Lewis
Cuyahoga Falls	W. E. Franz
Dayton	I. L. Lehman
	George Light
	W. W. Price
Delaware	T. C. Jones
	John F. Shoub
Dennison	J. R. Matson
East Liverpool	T. H. Stevens
Elyria	William M. Adams
Findlay	G. P. Schatzel
	John Seibel
Fostoria	E. L. Lepper
Fremont	R. L. Hottinger
	A. H. Lewis
	Elmer Loveland
Geneva	W. E. Donnelly
Granville	H. G. Miller
Greenville	D. S. Robertson
Homer	George D. Oberfell
	C. F. Ward
Ironton	I. S. Burford
Jefferson	Ross Riggs
Jewett	F. N. Donaldson
Lakewood	Edward Smith
Lancaster	William Blum
	J. C. Dallow
	John J. Klise
	James Murtaugh
	T. T. Vandergrift

Ohio — Continued.

Leetonia	R. W. Cushing
Malta	Henry C. Hopp
Mansfield	C. E. Carter
	Silas M. Douglass
	J. F. Olmstead
	Harry G. Leight
	R. L. Neely
	Clifton W. Sears
Marietta	F. H. Leidecker
	V. H. Lytle
	P. J. Quinlan
	F. L. Reed
Marion	M. A. Mickley
Massillon	J. E. Foster
	G. C. Tucker
Miamisburg	F. B. Reeser
Millersburg	H. H. Church
	C. F. Cluley
	J. S. Hatfield
Mt. Vernon	R. S. Lord
	C. O. Rockwell
	Martin A. Thiel
	Fred H. Thomas
Newark	R. E. Booth
	Homer R. Rogers
New Lexington	Ira I. Hazlett
New Philadelphia	W. H. Dimick
Portsmouth	John McMillan
Ravenna	E. P. Martin
St. Marys	Lemon G. Neely
Salem	H. A. Gager
	J. Arch. Harwood
	D. B. McCune
	J. H. Montgomery
Springfield	C. G. Abbott
	E. D. Abbott
Steubenville	H. W. Bishop, Jr.
	D. J. Daugherty
	L. S. Thomson
	R. H. West
Tiffin	H. F. Finley
Toledo	R. J. Burkhalter
	Frank Collins
	F. G. Geigel

Ohio — Concluded.

Toledo	Albert H. Gindele
	W. C. Longenecker
	Charles W. Mascho
	John B. McMahon
	James W. McMahon
	Charles S. Northrup
	W. H. Scott
Toronto	Louis Mathieu
Uhrichsville	J. D. Walton
Utica	Alpheus Snoke
	O. C. Teague
Warren	G. C. Lohr
Washington C. H.	G. N. Clapp
Wellston	Charles H. Garard
West Park	Charles Craft
	J. W. Irwin
	Peter L. Ostrye
Wooster	James C. Burtner
	F. D. Dougherty
	W. H. Frees
	Charles J. Helm
	A. G. Hottle
	Park Hovis
	H. B. Odenkirk
	George B. Wanamaker
Youngstown	John Baxter
	Harry P. Fish
	C. E. Gallagher
	D. J. Geary
	William E. Manning
	W. E. Watson
Zanesville	H. H. Dreibelbis
	D. B. Riggs

Oklahoma.

Ardmore	G. W. Russell
Bartlesville	H. C. Ballard
	Everett Carpenter
	Alfred J. Diescher
	F. F. Finney
	Francis P. Fisher
	C. L. Ford
	H. V. Foster
	C. N. Gould

Oklahoma — Concluded.

Bartlesville	Roy S. Hazeltine
	E. O. Hickstein
	W. W. Hill
	J. C. Howe
	J. J. Larkin
	George J. Newton
	W. W. Rhea
	R. O. Stull
Bristow	Frank Barnes
	Claude Freeland
Chandler	W. W. Bruce
Cushing	W. H. Tippett
Drumright	J. Foster Allen
	G. N. Rumbaugh
Guthrie	W. J. Dibbens
Muskogee	J. R. Doane
	H. C. Hoagland
Oklahoma City	Frank J. Meyer
Okmulgee	J. S. Clark
Pawhuska	H. H. Brenner
Ponca City	W. H. McFadden
Poteau	Howard N. Cassel
Sapulpa	C. C. Cantrell
Tulsa	Joseph Ardizzone
	W. H. Bagley
	Eugene Braden
	Glenn T. Braden
	Floyd J. Bradford
	Earl A. Clark
	Harry N. Greis
	Harry Heasley
	F. G. Heggem
	J. P. Herr
	A. W. Leonard
	Robert J. Lindsay
	W. R. Lindsay
	Frank L. Lewis
	M. P. Lyon
	John L. O'Donnell
	Fred J. Ossenbeck
	W. F. Potter
	Albert Watts
	A. M. Wilson

Pennsylvania.

Allegheny	W. H. Richards
Allison Park	J. Bossert
	D. Sample
Altoona	John Hilty
	C. E. Torrance
Apollo	A. F. Coulter
	Samuel McCutcheon
	John Young
Ardmore	I. N. Knapp
Aspinwall	Harry E. LeFevre
	Charles A. Ralph
Beaver Falls	F. C. Murphy
Belle Vernon	E. P. Nole
Bellevue	R. Dale Jolliffe
	S. C. Ross
Blairsville	Frank Heaslett
	J. M. Torrance
Braddock	L. R. Dingman
Bradford	T. N. Barnsdall, 2nd
	Elmer Beaty
	P. M. Berwald
	George P. Boothe
	A. A. Crawford
	R. R. Crowe
	Z. B. Custer
	L. E. Mallory
	Fred A. Miller
	A. J. Paris
	F. N. Smith
	S. D. Weaver
Brave	J. L. Ridgway
Brookville	R. B. Barnes
	F. C. Deemer
	C. F. Kimmell
	E. C. Whitcomb
	Guy H. Wingard
Brownsville	Thomas D. Hann
Burgettstown	D. W. Inghram
Butler	Ralph A. Beach
	Tom M. Black
	C. M. Heeter
	W. H. Larkin
	J. F. Lyon
	Samuel Redic

Pennsylvania — Continued.

Cabot	D. T. Beckett
Canonsburg	J. B. Black
	John Foley
	S. D. McCloy
	W. F. McGee
	A. G. McPeake
Carnegie	C. K. Walters
Clarion	C. F. Huff
	N. W. Reed
	George E. Waring
Clermont	W. H. Hovis
Connellsville	J. E. Angle
	C. J. Poole
Coraopolis	J. J. Ewing
	John J. O'Day
	Charles F. Shaffer
Cowansville	J. A. Adams
Creekside	Gabriel Watterson
Donora	J. H. Leathers
DuBois	F. M. Michel
	L. M. Simmons
East Brady	C. E. Cummings
East Pittsburgh	Thomas C. Clifford
Elderton	J. S. Siverling
Emlenton	C. E. Grant
Erie	Larmour Adams
	A. M. Blinn
	B. H. Donovan
	E. J. Germer
	Otto G. Hitchcock
	Frank H. Payne
	Charles J. Prior
	Henry P. Westcott
Evans City	A. S. Pfeifer
Fair Haven	J. S. Hildabrand
Ford City	P. E. Dixon
Franklin	G. K. Bigler
	J. M. Bridges
	C. J. Crawford
Freeport	T. H. Patterson
Gibsonia	George Fonner
Glenshaw	J. E. Conley
	J. M. Kay
	Anthony Leight

Pennsylvania — Continued.

Glenshaw	J. C. Titzel
	L. Wagner
Glenwillard	Frank Lackey
Greensburg	J. M. Klingensmith
	Earle Picke
	George B. Reeger
Greenville	A. C. Hartzell
Grove City	E. W. Jordan
Hallton	Frank G. Jackson
Halsey	S. F. Murphy
Harveys	D. J. Stokes, Jr.
Harmony	E. H. Hutchison
Homestead	H. L. Smith
Indiana	H. J. Bartley
	W. A. Bartley
	H. P. Beans
Johnstown	Robert Munro
Kane	L. C. Amey
	John Leonard
	R. J. Williams
Kittanning	John Crossett
	Peter M. Kerr
	Joseph Seice
	Z. H. Shuster
Latrobe	William Heaslett
	F. Shaw
Leechburg	J. O. Bothel
	Charles Knepshield
Lodlow	Dennis O'Leary
McDonald	Henry Cumings
	George Vallely
McKeesport	M. J. Garrity
McKees Rocks	W. S. Jewett
	D. A. Wolfe
Manor	W. C. McClellan
Mapletown	George B. Vance
Marwood	M. B. Cypher
Mayport	J. F. Anderson
Meadville	Hugh P. Brawley
	P. L. Mulkin
	F. V. Stein
Mercer	J. W. Ayer
Midland	J. H. Fonner
Midway	Charles R. Ballard

Pennsylvania — Continued.

Monessen	M. C. Crum
Mt. Morris	Robert Shear
Murraysville	W. S. King
	F. M. Sloan
New Bethlehem	Arthur Fleming
Newcastle	J. T. Campbell
New Kensington	E. E. Myers
	G. W. Zimmerman
Oakmont	J. S. McMunn
Oil City	P. C. Boyle
	W. P. Craig
	James B. Crawford
	Ronald B. Crawford
	Raymond Cross
	H. T. Egbert
	H. M. Ernst
	C. W. Gleason
	L. L. Graham
	Lynn Holbrook
	Willard Howe
	D. K. James
	John F. Mason
	C. E. Oliver
	Fred S. Rich
	W. O. Walker
	R. W. Ward
	Thomas R. Weymouth
	George Yardley
	William T. Young
Philadelphia	Henry S. Battin
	Samuel Taylor Bodine
	W. L. Brown
	Walton Clark
	W. F. Douthirt
	C. Willing Hare
	R. C. James
	J. B. Klumpp
	Lewis Lillie
	Sidney Mason
	John D. McIlhenny
	Rollin Norris
	Edward H. Rodgers
	Paul Thompson
	John S. Welch

Pennsylvania — Continued.

Pittsburgh .... Walter Abbe, Jr.
Daniel M. Armstead
A. A. Armstrong
W. H. Arnold
W. H. Arras
L. F. Barger
Theodore N. Barnsdall
James H. Barr
E. O. Bartlett
John C. Bartlett
R. H. Bartlett
E. L. Bartley
G. F. Batchelor
R. D. Beardsly
George K. Benner
J. E. Billingsley
Arthur Booth
C. J. Braun, Jr.
W. B. Brendlinger
George R. Brink
D. J. Brown
Louis Brown
James I. Buchanan
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H. W. Burson
J. P. Cappeau
W. B. Carson
O. W. Cashdollar
William C. Chaplin
W. B. Chapman
James Clark
Robert E. Clark
W. F. Cochran
John B. Corrin
C. F. Covey
A. B. Craig
C. E. Crawford
George W. Crawford
G. A. Crosby
R. H. Cunningham
A. B. Dally
A. P. Davis
R. D. Day
H. A. Dean

Pennsylvania — Continued.

Pittsburgh .... William C. Edwards
E. J. Egan
C. D. Evans
F. F. Falk
Otto F. Felix
T. B. Foley
T. H. Foley
L. C. Frohrieb
Louis B. Fulton
J. B. Garner
John Gates, Jr.
John E. Gill
J. R. Goldsborough
A. R. Gray
William T. Griswold
Joseph F. Guffey
E. F. Gwynn
F. L. Hadley
W. R. Hadley
C. T. Hall
W. W. Hall
R. W. Hannan
Ralph W. Hay
J. H. Healy
F. P. Hegerty
M. H. Henning
W. C. Higgins
H. D. Hildabrand
Dudley M. Hill
J. B. Hill
David O. Holbrook
A. G. Holmes
H. J. Hoyt
E. D. Ivory
Roswell H. Johnson
Russell A. Johnson
J. E. Kennan
J. W. Kelly
J. J. Kennedy
James King
Vergil P. Kline, Jr.
Frank H. Knapp
George T. Ladd
Charles A. Lawrence

Pennsylvania — Continued.

Pittsburgh .... Miles B. Layton
Edward D. Leland
F. A. Levy
T. L. Lewis
M. R. Marple
J. O. Martin
John G. McCabe
C. H. McCandless
Joseph McClellan
W. L. McCloy
W. A. McCombs
R. A. McRea
G. W. McCullough
Jesse Clark McDowell
George R. McKee
William McKee
John F. McKibben
J. J. McNally
C. A. Mechesney
Edwin C. Merrill
R. R. Miller
Fred W. Miner
C. S. Mitchell
Edgar M. Moore
Lee C. Moore
P. A. Moran
John J. Murray
A. J. Newman
Thomas Nicoll
Bert E. Nutt
C. W. O'Donnell
John Ostermaier
A. B. Patterson
William M. Patterson
Christy Payne
James G. Pew
John G. Pew
C. E. Pratt
C. S. Preston
H. A. Quay
William S. Ralston
Harvey Rankin
George W. Ratcliffe
J. A. Reed

Pennsylvania — Continued.

Pittsburgh .... James H. Reed
J. H. Reed, Jr.
G. W. Reel
E. B. Reeser
Harry C. Reeser
W. J. Reilly
George N. Riley
D. Robertson
E. S. Rooney
M. Romano
Willard J. Rowland
C. H. Rupp
Louis C. Sands
John H. Shalek
W. F. Schell
M. C. Schneider
Charles E. Seachrist
L. A. Seyffert
J. W. Sharp
John C. Sheppard
J. M. Simpson
E. A. Smith
H. L. Smith
M. C. Smith
R. H. Smith
W. H. Spain
W. A. Sprenkle
A. E. Staniek
S. B. Stewart
William Stewart
George J. Stuart
T. O. Sullivan
J. Roy Tanner
Prentiss H. Taylor
Edgar Thomas
Adam Tomer
John B. Tonkin
Ellis M. Treat
J. C. Trees
Howell Van Blarcom
William B. Way
H. H. Wentzel
E. P. Whitcomb
J. B. Wikoff

Pennsylvania — Continued.

Pittsburgh	R. L. Wilkes
	George Wittmer, Jr.
	George X. Wittmer
	Henry Wittmer
	Thomas Wittmer
	R. B. Woodworth
	W. H. Young
	C. W. Zimmerman
Portage	J. A. Sloan
Port Allegheny	J. W. Fonner
Portersville	F. W. Wimer
Ridgway	C. H. Law
Rochester	J. W. Hunter
	Harry Steinecker
Roulette	William A. Ditto
Rural Valley	Alfred Shoop
St. Marys	Philip Dixon
Sarver	William Boice
Sharon	J. P. Curry
	S. W. Snyder
Sharpsburg	W. E. Cole
	S. H. Eastland
Shinglehouse	A. J. Schlosser
Sigel	Grant West
Smithport	Louis E. Sterrett
South McConnellsville	William F. Richter
Tarentum	L. R. Silliman
Ten Mile Bottom	F. A. Cross
Tidioute	B. L. Miller
Titusville	W. T. Funk
	F. C. Hanchett
Turtle Creek	J. T. Bulger.
	C. R. Dietrich
Uniontown	F. L. Garard
	H. D. Hutchinson
	L. L. Miller
Van	J. P. Mansfield
Vandergrift	Charles Owens
Warren	H. H. Filler
	J. W. Kitchen
	C. P. McCalmont
	H. H. McConnell
Washington	Clarence F. Bormann
	James P. Eagleson

Pennsylvania — Concluded.

Washington	A. D. Knightlinger
	William O'Brien
	Hose Schaffer
	W. P. Simmons
	Chris. Stainbrook
	Patrick Yorke
Waynesburg	C. E. Dittman
	J. L. Fye
	John Glass
	C. P. LeVier
	J. Y. McClelland
	W. E. Nestor
	Charles O'Hara
	Lawrence O'Hara
	P. A. Troutman
Wilkinsburg	S. E. W. Burnside
	T. L. Galvin
	W. S. Ketler
	J. W. Kidd
	George A. Kinley
	J. A. Lambing
	Harry Porterfield
	William Reichert
	T. B. Wilson
Woodlawn	Arthur McClellan
	George L. Ratcliffe
Zelienople	A. R. Burnett

Rhode Island.

Providence	George S. Barrows

Texas.

Abilene	George H. Caffrey
Atlanta	William E. Sipe
Corsicana	E. R. Brown
Dallas	J. E. Hutchinson
	H. E. Manley
	H. C. Morris
	R. G. Soper
Denison	T. W. H. Flinn
Fort Worth	L. E. Barrows
	W. P. Gage
	D. P. Harrington

Texas — Concluded.

Fort Worth	F. W. Kirk
	Tom Pinkston
	O. K. Shannon
Gainesville	W. E. Milne
Groesbeck	R. L. Underwood
Laredo	M. P. Cullinan
	James H. Howard
Marshall	W. H. Sedberry
Moran	William Little
	Joseph Merket
Petrolia	C. M. Baker
Port Arthur	J. S. Connelly
Texarkana	L. K. Whitehead
Wichita Falls	W. C. Gibson

West Virginia.

Atwood	M. G. Sherwood
	N. J. Taylor
Branchland	S. E. Leist
	L. P. McAllister
	D. M. Poe
Bridgeport	French Nicholson
Cameron	M. J. Cumings
	Bud Wise
Charleston	R. G. Altizer
	J. C. Blair
	George K. Carpenter
	Frank Cox
	C. S. Duffield
	John C. Ford
	J. E. Frazier
	William Freudenberger
	Fred Paul Grosscup
	Paul B. Grosscup
	George F. Hennessey
	James C. Heydrick
	D. C. Jay
	D. A. Ketchum
	Robert Lockhart
	R. M. Parks
	J. W. Penhale
	J. L. Perdue
	Edward Sackett

West Virginia — Continued.

Charleston	P. C. Sloane
	A. C. Smith
	H. A. Wallace
	James B. Weir
	W. W. Wolfe
Clarksburg	W. F. Alexander
	S. W. Bowman
	D. J. Carter
	H. C. Cooper
	D. W. Cork
	Fillmore Devericks
	R. F. Dolen
	J. J. Evans
	F. B. Haymaker
	Boyd E. Horner
	Lynn S. Horner
	Howard Jenkins
	L. G. Kincheloe
	W. C. McMasters
	J. F. McNary
	John Mowrey
	T. B. Peddicord
	Ernest Randolph
	Charles C. Reed
	William J. Schiffler
	Bert Singleton
	J. H. Williams
Clendenin	T. R. Cartwright
	L. V. Koontz
Fairmont	Curtis B. Fleming
	G. H. Jackson
	Nicholas Powers
	F. B. Pryor
	Edwin Robinson
	F. L. Stuchell
Fairview	Lon Lavell
Grafton	T. W. Engle
Hastings	C. W. Boocks
	Roy Glass
Hundred	Nile Hunt
	H. B. Mayne
	H. F. Walsh
	T. J. White
Huntington	D. E. Abbott

West Virginia — Continued.

Huntington	E. G. Burns
	O. L. Davies
	F. B. Enslow
	G. I. Gassdorf
	E. J. Greenwalt
	J. F. Kent
	E. J. King
	J. T. McClintock
	James P. McCloskey
	John J. Nash
	Raymond J. Nash
	G. A. Northcott
	G. H. Reckard
	J. W. Reeser
Kenova	Deo Jimerson
Kermit	R. C. Leard
Littleton	J. P. Campbell
	R. J. Clarkson
Lumberport	David White
McWhorter	W. J. Droppleman
Majorsville	Oliver Steele
Mannington	C. M. Fleming
	R. B. Howard
	Thomas J. Jones
	W. T. Smith
Miami	L. D. Ikard
	A. R. Rich
Middlebourne	W. S. Kingsley
Miletus	W. N. Baker
Morgantown	A. T. Casto
	D. H. Courtney
	D. F. Dusenberry
	Jesse J. Hall
	Clement Ross Jones
	J. H. McDermott
	E. D. Sibley
	W. H. South
	I. C. White
Moundsville	F. O. Funk
	George Luther
	S. W. Meals
Parkersburg	F. P. Burns
	J. T. Callanan
	David B. Crawford

West Virginia — Concluded.

Parkersburg	John M. Crawford
	Herman J. Hogg
	E. A. Kenney
	Edward B. Rich
	Wade H. Tonkin
	E. W. Williamson
Porters Falls	John Phillips
Proctor	F. G. Burson
	N. J. Klug
Ranson	John B. Brazier
Reader	Hugh Anderson
St. Marys	A. I. Sutton
Salem	M. L. Campbell
	J. E. Frainer
	J. K. Swartz
Sistersville	F. W. Martin
Smithfield	George B. Meredith
Smithville	I. D. Frantz
Spencer	J. F. Geist
	A. S. Heck
	Thomas F. O'Brien
Wallace	Charles E. Baker
	Silas Davis
	Harry Moore
Wellsburg	George C. Wells
Weston	Henry Brewster
	C. C. Dunham
	George L. Hinerman
	James J. Logue
	Edward P. McCall
	H. J. McGilvary
	L. J. McNary
	George W. Schell
	William L. Sheets
	J. W. Taylor
	J. W. Wilson
West Union	P. S. Hazlett
	John C. Stett
Wheeling	John Duncan
	A. S. Hare
	J. F. Nestor
	George B. Riddle
Wilsonburg	K. H. Bane
	Charles Caveneau

Wisconsin.

Milwaukee	A. C. Rutz
	J. C. Wilson

Argentine Republic.

Buenos Aires	Alberto Schneidewind

CANADA.

Alberta.

Calgary	R. L. Bevan
	Dillon Coste
	Eugene Coste
	Stuart W. Davies
	F. J. Hueperman
	Porter D. Mellon
	I. A. Payne
	H. V. Pearson
	H. S. Tims

Ontario.

Brantford	F. Fair
Chatham	R. L. Pattinson
	W. G. Ryan
Hamilton	H. W. Braden
	A. F. Covey
	Clarence H. Grace
	A. G. May
	John B. McNary
London	James C. Duffield
	Frank B. Tomb
	James M. H. Young
St. Catherines	P. I. Price
St. Thomas	C. C. Roberts
Sarnia	John B. Williams
Simcoe	Harrison Stringer
Toronto	W. W. Near
Windsor	R. B. Kilpatrick
	T. Pates Pinckard
	Gordon D. Wickett
Woodstock	James A. Doherty

England.

London	Arthur Graham Glasgow
	J. A. L. Henderson
	Campbell M. Hunter

Holland.

Amsterdam	Dr. E. D. Pyzel

Hungary.

Budapest	Jacques Kanitz Louis Katona

Mexico.

Tampico	James S. Posgate

SUMMARY OF GEOGRAPHICAL DISTRIBUTION.

Alabama	1	Ohio	253
Arkansas	15	Oklahoma	52
California	14	Pennsylvania	423
Connecticut	3	Rhode Island	1
District of Columbia	2	Texas	25
Illinois	18	West Virginia	159
Indiana	13	Wisconsin	2
Kansas	37	Argentine Republic	1
Kentucky	9	Canada	29
Louisiana	21	England	3
Massachusetts	1	Holland	1
Maryland	2	Hungary	2
Michigan	7	Mexico	1
Missouri	21		
New Jersey	3	Total	1,181
New York	62		

THE ASSOCIATION OF NATURAL GAS SUPPLY MEN

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Allegheny Steel Co.	Pittsburgh, Pa.
Anchor Packing Co.	Pittsburgh, Pa.
Bessemer Gas Engine Co.	Grove City, Pa.
Borden Company	Warren, Ohio.
The Bristol Co.	Waterbury, Conn.
Broderick & Bascom Rope Co.	St. Louis, Mo.
Bryant Heater & Mfg. Co.	Cleveland, Ohio
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A. M. Byers Co.	Pittsburgh, Pa.
Carnegie Steel Co.	Pittsburgh, Pa.
Chaplin-Fulton Mfg. Co.	Pittsburgh, Pa.
Cincinnati Rubber Mfg. Co.	Cincinnati, Ohio
Clark & Norton Mfg. Co.	Wellsville, N. Y.
Cleveland Gas Meter Co.	Cleveland, Ohio
Colona Mfg. Co.	Pittsburgh, Pa.
Columbia Gas Stove Co.	Huntington, W. Va.
Columbian Rope Co.	Auburn, N. Y.
Columbus Heating & Ventilating Co.	Columbus, Ohio
Continental Supply Co.	St. Louis, Mo.
C. & G. Cooper Co.	Mt. Vernon, Ohio
Crandall Pettee Co.	New York City
Dalton Adding Machine Co.	Cincinnati, Ohio
Davis-Bournonville Co.	Jersey City, N. J.
Dayton Pipe Coupling Co.	Dayton, Ohio
N. C. Davison Gas Burner & Welding Co.	Pittsburgh, Pa.
Draeger Oxygen Apparatus Co.	Pittsburgh, Pa.
S. R. Dresser Mfg. Co.	Bradford, Pa.
Equitable Meter Co.	Pittsburgh, Pa.
Erie City Iron Works	Erie, Pa.
Erie Trailer Mfg. Co.	Erie, Pa.
Estate Stove Co.	Hamilton, Ohio

Fairbanks, Morse & Co.	St. Louis, Mo.
Edwin H. Fitler Co.	Philadelphia, Pa.
The Foxboro Co.	Foxboro, Mass.
The Franklin Co.	Canton, Ohio
Frick & Lindsay Co.	Pittsburgh, Pa.
Fuel Oil Journal	Houston, Tex.

Garlock Packing Co.	Palmyra, N. Y.
The Gas Age	New York City
Gas Appliance Co.	Cleveland, Ohio
Gas Record	Chicago, Ill.
General Fire Extinguisher Co.	Providence, R. I.
Germer Stove Co.	Erie, Pa.
B. F. Goodrich Co.	Akron, Ohio
Graves Supply Co.	Cincinnati, Ohio
Gwynn Gas Burner & Eng. Co.	Pittsburgh, Pa.

Hammon Coupler Co.	Pittsburgh, Pa.
Haymond Co.	Muncie, Ind.
Hays Mfg. Co.	Erie, Pa.
Hazard Mfg. Co.	Chicago, Ill.
C. M. Heeter, Sons & Co., Inc.	Butler, Pa.
Hewitt Rubber Co.	Pittsburgh, Pa.
Hooven, Owens, Rentschler Co.	Hamilton, Ohio
Hope Engineering & Supply Co.	Pittsburgh, Pa.

The Ideal Heating Co.	Columbus, Ohio
Ingersoll-Rand Co.	Pittsburgh, Pa.
International Hale Gas Mixer Mfg. Co.	Detroit, Mich.

Jarecki Mfg. Co.	Erie, Pa.
Jiffy Water Heater Co.	St. Louis, Mo.

LaBelle Iron Works	Steubenville, Ohio
A. Leschen & Sons Rope Co.	St. Louis, Mo.
Lezius Automatic Draft Regulator Co.	Cleveland, Ohio
Lucey Mfg. Corporation	Pittsburgh, Pa.
Ludlow Valve Mfg. Co.	Pittsburgh, Pa.

Macomber & Whyte Rope Co.	Kenosha, Wis.
Manhattan Rubber Mfg. Co.	Passaic, N. J.
Manufacturers Light & Heat Co.	Pittsburgh, Pa.
Mark Mfg. Co.	Chicago, Ill.
Meek Oven Co.	Newburyport, Mass.
Metric Metal Works	Erie, Pa.

Minneapolis Heat Regulator Co.	Minneapolis, Minn.
Modern Iron Works	Quincy, Ill.
Modern Safety Gas Iron Co.	Philadelphia, Pa.
The Moon Mfg. Co.	Chicago, Ill.
Lee C. Moore & Co., Inc.	Pittsburgh, Pa.
Moser Mfg. Co.	Kane, Pa.
H. Mueller Mfg. Co.	Decatur, Ill.

Nathan Mfg. Co.	New York City
National Supply Co.	Pittsburgh, Pa.
National Transit Pump & Machine Co.	Oil City, Pa.
National Tube Co.	Pittsburgh, Pa.
Natural Gas Journal	Buffalo, N. Y.
New Bedford Cordage Co.	New York City
New York Belting & Packing Co.	New York City
A. T. Nye & Son Co.	Marietta, Ohio

Oil & Gas Journal	Tulsa, Okla.
Oil City Boiler Works	Oil City, Pa.
Oil Well Supply Co.	Pittsburgh, Pa.
Oxweld Acetylene Co.	Chicago, Ill.

Parkersburg Machine Co.	Parkersburg, W. Va.
Parkersburg Rig & Reel Co.	Parkersburg, W. Va.
Peerless Heater Co.	Pittsburgh, Pa.
Pennsylvania Furnace & Stove Co.	Warren, Pa.
Pittsburg Meter Co.	East Pittsburg, Pa.
Pittsburg Reinforced Brazing & Machine Co.	Pittsburg, Pa.
Pittsburg Valve & Fittings Co.	Pittsburg, Pa.
Pittsburg Valve, Foundry & Construction Co.	Pittsburg, Pa.
Pittsburg Water Heater Co.	Pittsburg, Pa.
Plymouth Cordage Co.	North Plymouth, Mass.
Pratt & Cady Co., Inc.	New York City
Prichard Supply Co.	Mannington, W. Va.

Jos. Reid Gas Engine Co.	Oil City, Pa.
Reliable Stove Co.	Cleveland, Ohio
Rensselaer Valve Co.	Troy, N. Y.
Republic Iron & Steel Co.	Youngstown, Ohio
Revere Rubber Co.	Chelsea, Mass.
Reznor Mfg. Co.	Mercer, Pa.
Riesenman Mfg. Co., Ltd.	Franklin, Pa.
L. E. Robinson & Co.	Oil City, Pa.
Robinson Packer & Machine Co.	Coffeyville, Kan.
John A. Roebling Sons Co.	Trenton, N. J.

Rossendale-Reddaway Belting & Hose Co	Newark, N. J.
Ruud Mfg. Co	Pittsburgh, Pa.
Sanitary Company of America	Linfield, Pa.
Schaeffer & Budenberg Mfg. Co	Pittsburgh, Pa.
Selas Co.	Canton, Ohio
Solar Light Co	New York City
Spang, Chalfant & Co	Pittsburgh, Pa.
Sprague Meter Co	Bridgeport, Conn.
Strause Gas Iron Co	Philadelphia, Pa.
Sun Vapor & Gas Street Light Co	Canton, Ohio
Superior Gas Engine Co	Springfield, Ohio
Tate-Jones & Co., Inc	Pittsburgh, Pa.
W. P. Taylor Co	Buffalo, N. Y.
Toledo Pipe Threading Machine Co	Toledo, Ohio
Troop Mfg. Co	Pittsburgh, Pa.
United Seal Co	Columbus, Ohio
Utica Valve & Fixture Co	Utica, N. Y.
Welsbach Co.	Gloucester City, N. J.
Westinghouse Machine Co	Pittsburgh, Pa.
Wheeling Steel & Iron Co	Wheeling, W. Va.
Linden W. Wolfe	Oil City, Pa.
Worthington Pump & Machinery Corp	Buffalo, N. Y.
Wright Wire Co	Worcester, Mass.
Youngstown Sheet & Tube Co	Youngstown, Ohio